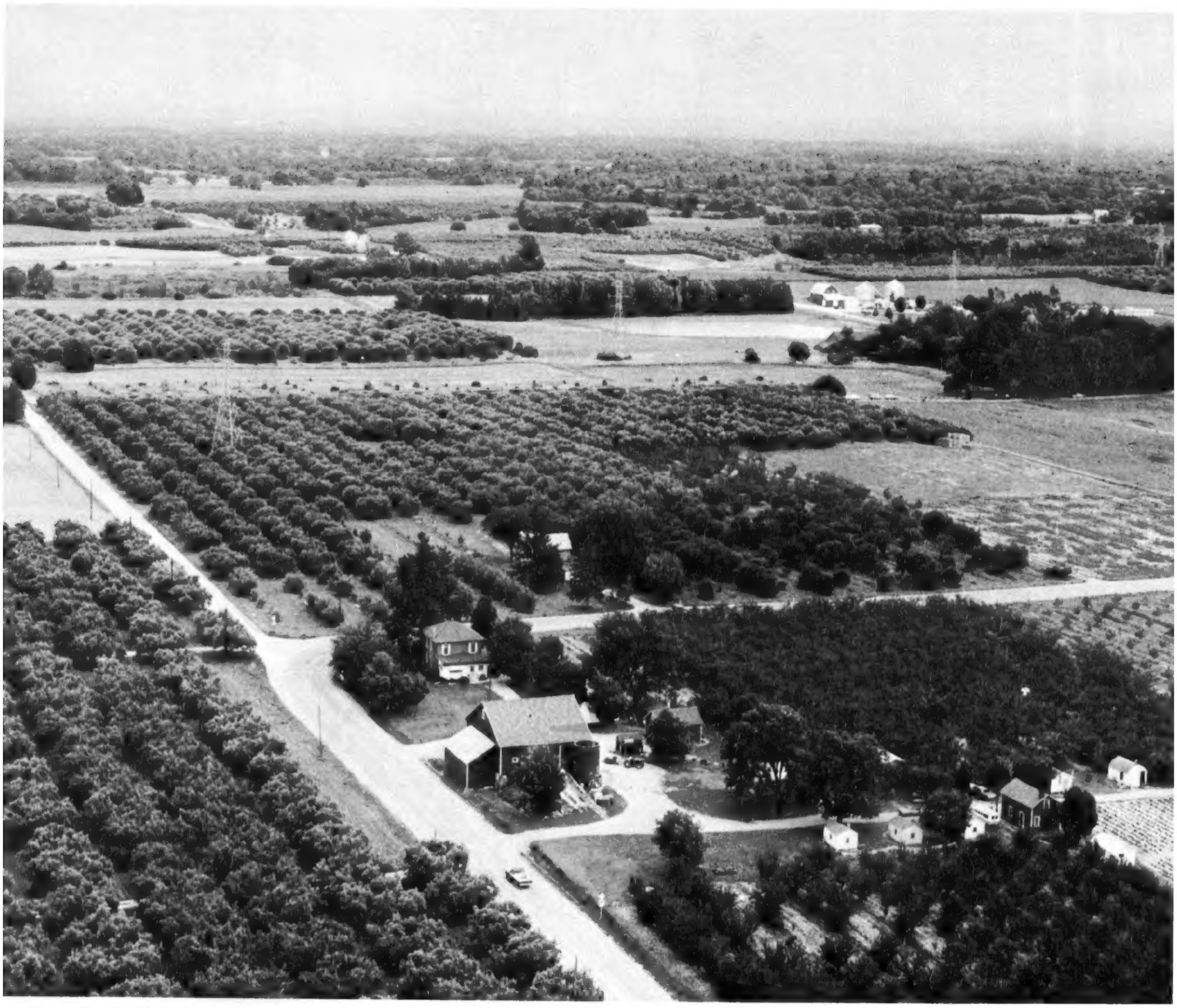
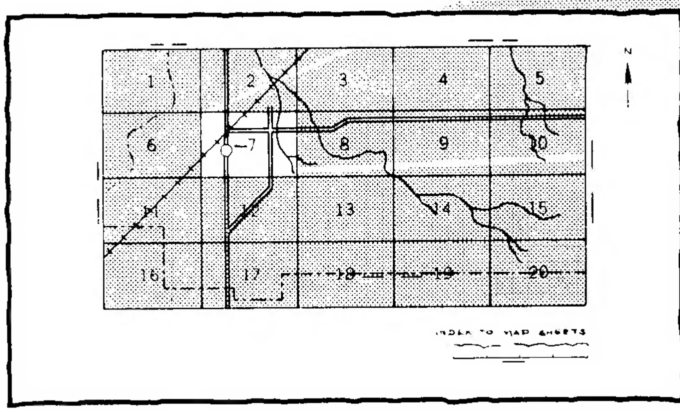
SOIL SURVEY OF
Berrien County, Michigan

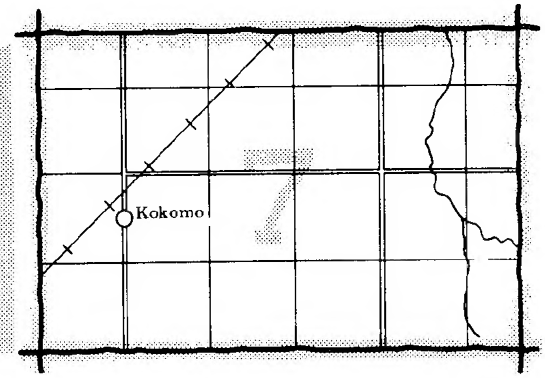


United States Department of Agriculture
Soil Conservation Service
in cooperation with
Michigan Agricultural Experiment Station

HOW TO USE

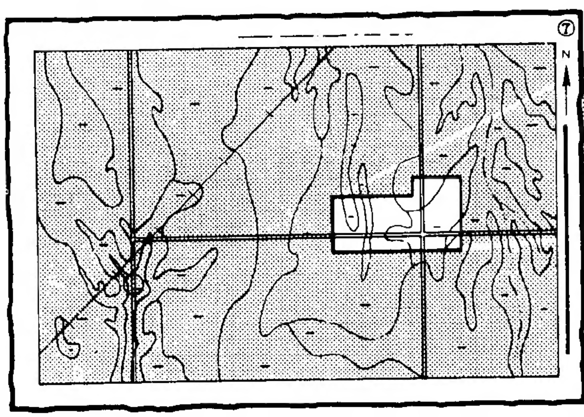
1. Locate your area of interest on the "Index to Map Sheets" (the last page of this publication).

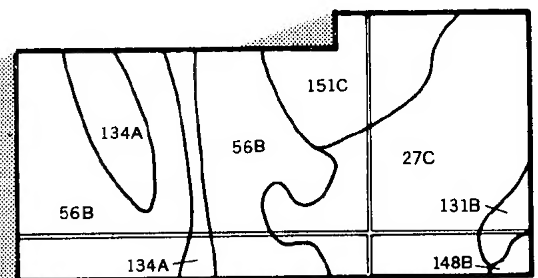




2. Note the number of the map sheet and turn to that sheet.

3. Locate your area of interest on the map sheet.





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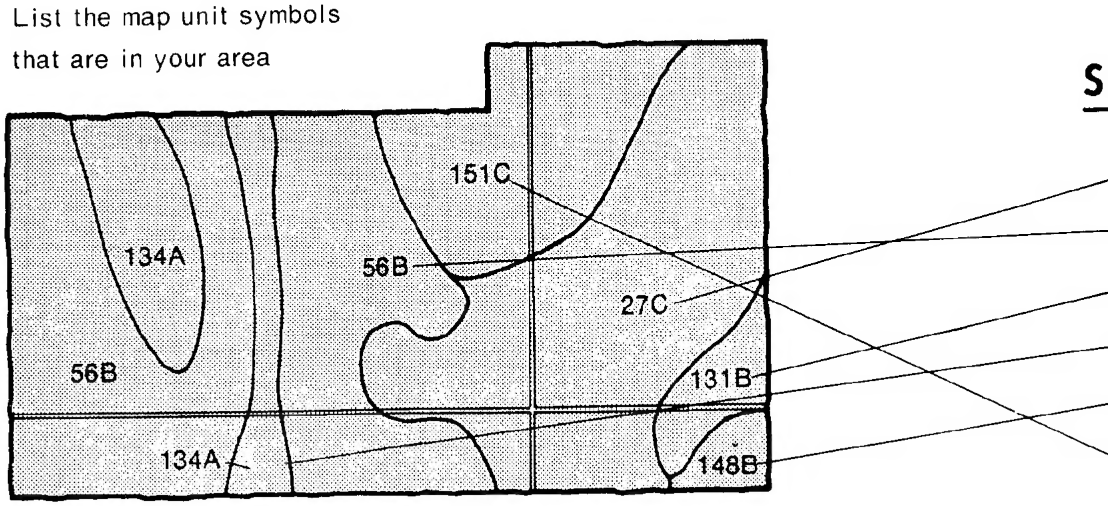

Symbols

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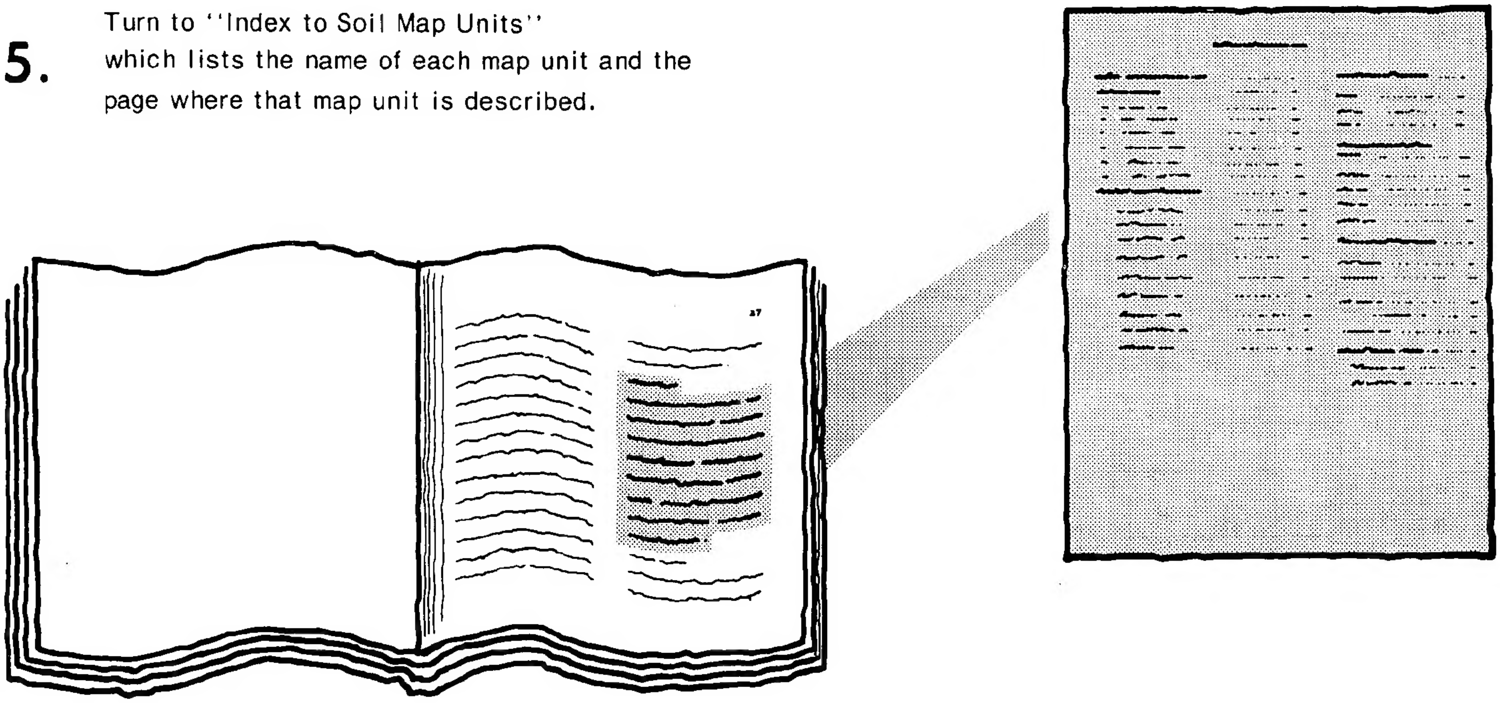
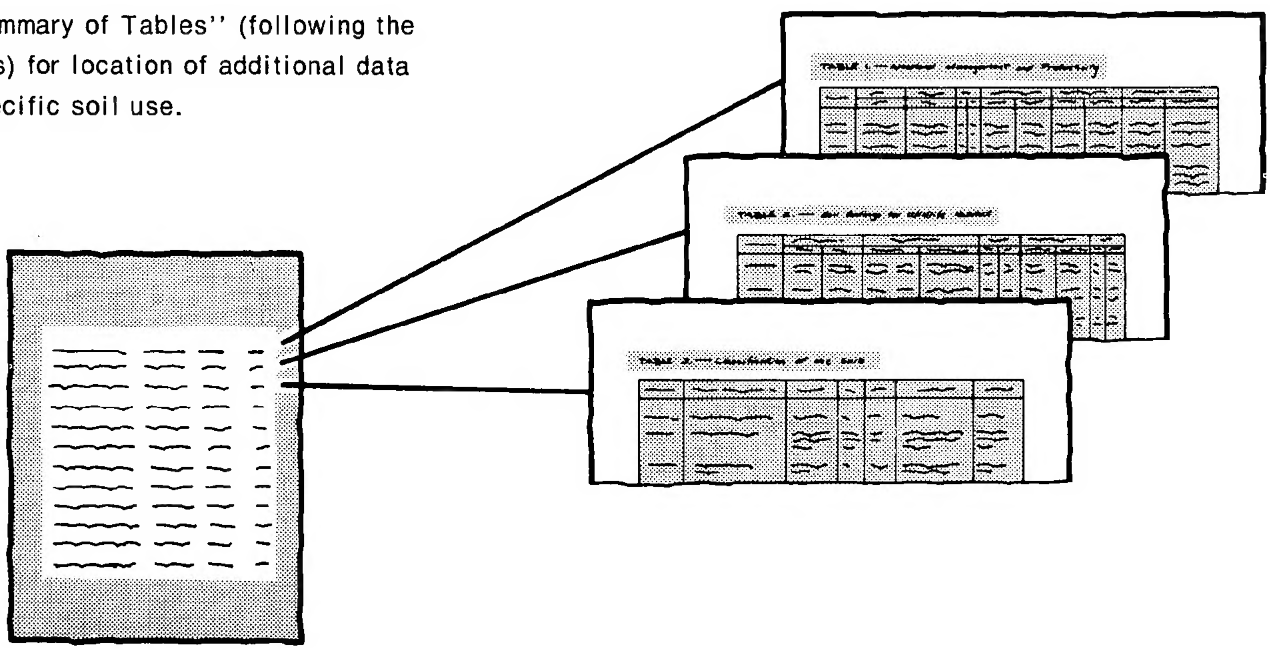
THIS SOIL SURVEY

5. Turn to "Index to Soil Map Units" which lists the name of each map unit and the page where that map unit is described.



6. See "Summary of Tables" (following the Contents) for location of additional data on a specific soil use.



7. Consult "Contents" for parts of the publication that will meet your specific needs. This survey contains useful information for farmers or ranchers, foresters or agronomists; for planners, community decision makers, engineers, developers, builders, or homebuyers; for conservationists, recreationists, teachers, or students; for specialists in wildlife management, waste disposal, or pollution control.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Serivce has leadership for the federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was performed in the period 1974 to 1978. Soil names and descriptions were approved in March, 1979. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1978. This survey was made cooperatively by the Soil Conservation Service and the Michigan Agricultural Experiment Station. It is part of the technical assistance furnished to the St. Joseph River Soil Conservation District and the Galien River Soil Conservation District. Financial assistance was made available by the Berrien County Board of Commissioners.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

Cover: Typical landscape of Riddles-Ockley-Oshtemo association. Orchard crops and vegetables are important to Berrien County's economy.

contents

soil series

Issued November 1980

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summary of tables

foreword

This soil survey contains information that can be used in land-planning programs in Berrien County, Michigan. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to insure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.

Arthur H. Cratty
State Conservationist
Soil Conservation Service

soil survey of
Berrien County, Michigan

By Jerry D. Larson, Soil Conservation Service

Fieldwork by Jerry D. Larson, Soil Conservation Service,
and Clare DenBesten, Karl F. Hausler, Erik Johnson, Roy Shaft,
Dan Tippy, and David Walling, Berrien County

United States Department of Agriculture, Soil Conservation Service
in cooperation with Michigan Agricultural Experiment Station

BERRIEN COUNTY is in the extreme southwestern part of Michigan, bordering on Lake Michigan and Indiana (fig. 1). It has an area of 584 square miles, or 373,760 acres. St. Joseph, the county seat, is located in the northern part of the county along Lake Michigan. The population of Berrien County in 1975 was about 170,000.

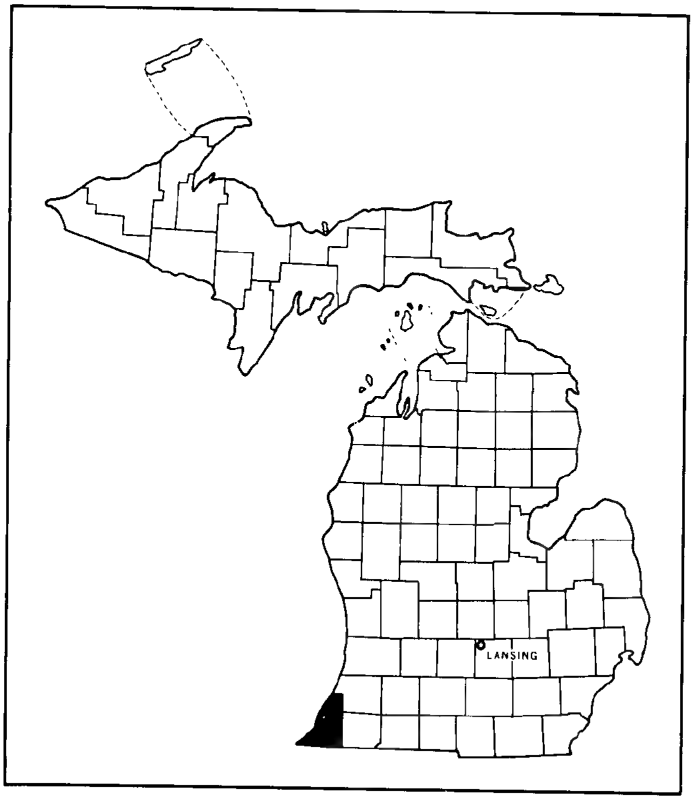

Figure 1.—Location of Berrien County in Michigan.

Most of Berrien County is gently sloping moraines and till plains with flat to nearly level lake plains and outwash plains. Deeply entrenched drainageways dissect the county, with streams flowing westerly to Lake Michigan. The St. Joseph River is the largest in the county.

Farming is the main economic enterprise in the county. Prevailing winds from Lake Michigan moderate the air temperature, making the climate in the northern part of the county favorable for orchard crops and vineyards (fig. 2). The climate in the southern part of Berrien County is favorable for cash grain crops and livestock farming. The major crops are corn, wheat, soybeans, and hay.

Major industries are appliance and heavy earthmoving equipment manufacturing. Small industries include food processing and electronic equipment manufacturing.

Soil scientists have determined that there are about 42 different kinds of soil series in Berrien County. The soils range widely in texture, natural drainage, slope, and other characteristics. Wetness is a major limitation to the use of many of these soils. Extensive tile drainage, however, has made the soils well suited to field crops. Because of wetness, many of the soils are generally poorly suited to most other land uses.

The sloping soils in Berrien County are dominantly well drained or moderately well drained and have a wide range of textures. The hazard of erosion is generally severe on these soils. Measures are needed to control erosion and reduce sedimentation in streams. If well managed, the soils are well suited to field crops, pasture, orchard crops, and vineyards (fig. 3). The well drained soils,

Figure 2.—Orchards and vineyards on the soils of the Spinks-Oakville-Oshtemo association contribute to the economic growth of the county.

making up about half of the county, are well suited to urban development.

The first soil survey of Berrien County was published in 1927. This current survey provides additional information. It also provides maps on a larger scale that show the soils in greater detail.

Descriptions, names, and delineations of soils in this soil survey do not fully agree with those on soil maps for adjacent counties. Differences are the result of better knowledge of soils, modifications in series concepts, intensity of mapping, or the extent of soils within the survey area.

general nature of the county

This section gives general information about the county. It discusses climate; history and development; farming; industry and transportation; physiography, relief, and drainage; and lakes and streams.

climate

Prepared by the Michigan Department of Agriculture, Michigan Weather Service, East Lansing, Michigan.

Tables 1 and 2 give data on temperature and precipitation for the survey area as recorded at Benton

Harbor and Eau Claire in the period 1948 to 1977. Table 3 shows probable dates of the first freeze in fall and the last freeze in spring. Table 4 provides data on length of the growing season.

In winter the average temperature is 27 degrees F, and the average daily minimum temperature is 20 degrees. The lowest temperature on record, which occurred at Benton Harbor on January 12, 1918, is -21 degrees. In summer the average temperature is 70 degrees, and the average daily maximum temperature is 81 degrees. The highest recorded temperature, which occurred at Benton Harbor on June 25, 1937, is 109 degrees.

Growing degree days are shown in tables 1 and 2. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (50 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is 36 inches. Of this, 20 inches, or 56 percent, usually falls in April through September, which includes the growing season for most crops. In 2 years out of 10, the rainfall in April through September is less than 16 inches. The heaviest 1-day rainfall during the period of record was 6.60 inches at Benton Harbor on May 30, 1943. Thunderstorms occur on about 42 days each year, and most occur in summer.

Average seasonal snowfall is 67 inches. The greatest snow depth at any one time during the period of record was 35 inches on January 15, 1893, and 31 inches on January 27, 1978. On an average of 61 days, at least 1 inch of snow is on the ground. The number of such days varies greatly from year to year.

The greatest total seasonal snowfall was 135.5 inches at Eau Claire during 1977 and 1978. The least total seasonal snowfall was 9.5 inches at Benton Harbor

Figure 3.—Typical landscape of Blount-Rimer association, showing orchards, vineyards, and soybean fields south of St. Joseph.

during 1948 and 1949. The heaviest 1-day snowfall on record was more than 25 inches on December 6, 1937.

The average relative humidity in midafternoon is about 63 percent. Humidity is higher at night, and the average in the morning is about 82 percent. The sun shines 67 percent of the time possible in summer and 37 percent in winter. The prevailing wind is from the south-southwest. Average windspeed is highest, 12.4 miles per hour, in March from the north-northwest.

history and development

The Legislative Council of the Territory of Michigan created Berrien County in September, 1831, with the county seat in Niles (*3*). The county was named after John M. Berrien, Andrew Jackson's Attorney General. St. Joseph became the county seat in 1894.

Robert Cavelier LaSalle was the first settler in Berrien County(*5*). He spent the winter of 1669 in a fort he built at St. Joseph. The French explorers and traders and Indians controlled the county until 1759, when the English won the Battle of Quebec and took over the Great Lakes Area. Spain took Fort St. Joseph at Niles in 1781 but renounced it immediately. The Americans took control of the territory from the British in 1796.

In those early days, white oak, tulip poplar, ash, beech, maple, and black walnut forests grew on areas of prairie. In 1823, the first farm settlers came to Niles from Virginia and the Carolinas. In 1831, St. Joseph was established as a shipping port. It handled more tonnage than Chicago until 1843. In 1835, the first peach tree was imported. By 1872, 140,000 bushels of peaches were being shipped out of St. Joseph-Benton Harbor each year. In 1836, the lumber industry was started with shipbuilding being very important.

The St. Joseph River, the Paw Paw River, and the Galien River were Berrien County's earliest highways. Territorial Road and Old Chicago Road, built between 1829 and 1836, connected the county by land with Chicago, Kalamazoo, and Detroit. A railroad went through New Buffalo around 1840, connecting Chicago, New Buffalo, Niles, and Kalamazoo (*4*).

Today, fruit farming is so important in the county that a festival, "Blossom Time," is celebrated every spring. It was first celebrated in 1924.

farming

The total area of Berrien County is 373,760 acres. According to the 1974 U. S. Census of Agriculture (*12*), about 52.8 percent of this total area, or 196,077 acres, was farmland. The average size of a farm was 100 acres. The rest consisted mainly of state land, privately owned woodland, abandoned farmland, urbanland, recreational and industrial areas, and resorts. In 1974, 7,054 acres was irrigated.

In 1974, 1,959 farms were in the county (*6*). Of this total, 907 ranged from 1 to 49 acres; 479, from 50 to 90 acres; 405, from 100 to 259 acres; 120, from 260 to 499 acres; 41, from 500 to 999 acres; and 7, from 1,000 to 1,999 acres.

Corn was the chief row crop in 1974, covering 38,319 acres. Small grain was also important. Included were 12,254 acres of wheat, 2,067 acres of oats, and 609 acres of other grains. The acres of soybeans harvested amounted to 14,689. Hay was planted on 9,333 acres. Apples were grown on 10,771 acres, peaches on 4,329 acres, pears on 1,789 acres, cherries on 5,562 acres, grapes on 6,854 acres, and plums on 1,008 acres. Vegetables were planted on 10,050 acres, of which 3,545 acres was irrigated.

industry and transportation

Many large international corporations are located in Berrien County. Food processing, metal working, paper processing, nuclear power, agriculture, electronics, and plastics are other types of industries employing a major part of the county's population. The resort industry is also important in Berrien County.

Transportation is by water, air, railroads, and highways. Benton Harbor-St. Joseph is a commercially important lake port. New Buffalo is also a harbor.

There are three paved airports in the county: Ross Field in Benton Township, Jerry Tyler Memorial Airport in Niles Township, and Oselka Airport in Three Oaks Township. There are also several municipal and private airstrips.

A railroad extends north-northeast through the county from Chicago through Holland. Another railroad extends east-west connecting Chicago and Kalamazoo.

Five major regional, state, and federal highways serve Berrien County. I-94 is a six- and four-lane highway extending northeast, connecting Chicago and Kalamazoo. I-196 is a four-lane, north-south highway connecting Benton Harbor and Grand Rapids. U.S. 33 and 31 is a two-lane highway, extending southeast, connecting South Haven and South Bend. U.S. 12 is an east-west, two-lane highway, connecting Chicago and Ann Arbor. State M-140 is a north-south, two-lane highway, connecting Niles and South Haven.

physiography, relief, and drainage

The bedrock of Berrien County consists of the edges of bowl-like rock formations that fill the Michigan Basin. The oldest rock is the Antrim Shale which underlies all of the county and is the uppermost bedrock in the southern part of the county. Overlapping the Antrim Shale, in the central part of the county, is the Ellsworth Shale, which is overlapped by the Coldwater Shale in the northwestern part of the county.

Overlying these rock formations is a mass of glacial drift that was deposited during the Wisconsin Glacial period. When the ice melted 12 to 13 thousand years ago, it left deposits of raw soil material that ranged from

less than 100 feet to more than 400 feet in thickness. Such deposits covered all of the area that is now Berrien County. The present surface features are, for the most part, the results of glacial action (fig. 4).

Variations in relief in the county are not great. The elevation at the shore of Lake Michigan is about 500 feet, and the highest elevation in the county is slightly more than 900 feet. Local differences in elevation exceed 150 feet in only a few places.

Four well defined topographic divisions that extend roughly parallel to the Lake Michigan shore are recognized. The first division is a discontinuous glacial lake plain that is 10 to 15 feet above the lakeshore and is covered in many places by sand dunes rising to over 200 feet above Lake Michigan. Remnants of this lake plain, devoid of the sand dunes, are near Grand Mere Lakes and extend up the Paw Paw and St. Joseph River valleys. Drainage of this physiographic division is deranged. Wet soils and mucks are in the cone-shaped depressions of the dunes and in swales and ancient embayments behind the dunes.

A second division is a nearly level plain about 40 to 80 feet above Lake Michigan. This physiographic division generally lies behind the dunes but reaches the lake in places, terminating in steep bluffs. This area varies from 6 to 8 miles in width, except where it widens and merges with the terraces of the St. Joseph River southeast of St. Joseph. This plain is apparently the remnant floor of glacial Lake Chicago, which covered earlier deposits of glacial till. Stratified lacustrine deposits; an intermittent layer of sand; and low, isolated, narrow ridges of sand—apparently representing ancient beaches—have been deposited over the clay loam floor, giving rise to an intricate pattern of wet and dry soils. The surface drainage is deranged with a few deeply incised streams.

A third division consists of broad swells; inconspicuous, smooth ridges; and detached high plains lying at slightly higher levels than the second physiographic division. This third division forms separate, elongated areas within the second division and corresponds with the Lake Border and Tinley Terminal Moraines. The land is 80 feet to 120 feet above Lake Michigan. The absence of the original inequalities and constructional features common to moraines indicates erosional and depositional events, possibly tied to wave action and deposition from a smaller glacial lake that is ponded between this moraine and the Valparaiso Terminal Moraine to the east. This division is predominantly somewhat poorly drained and has deranged surface drainage.

The fourth major division comprises most of the eastern two-thirds of the county. This topographic

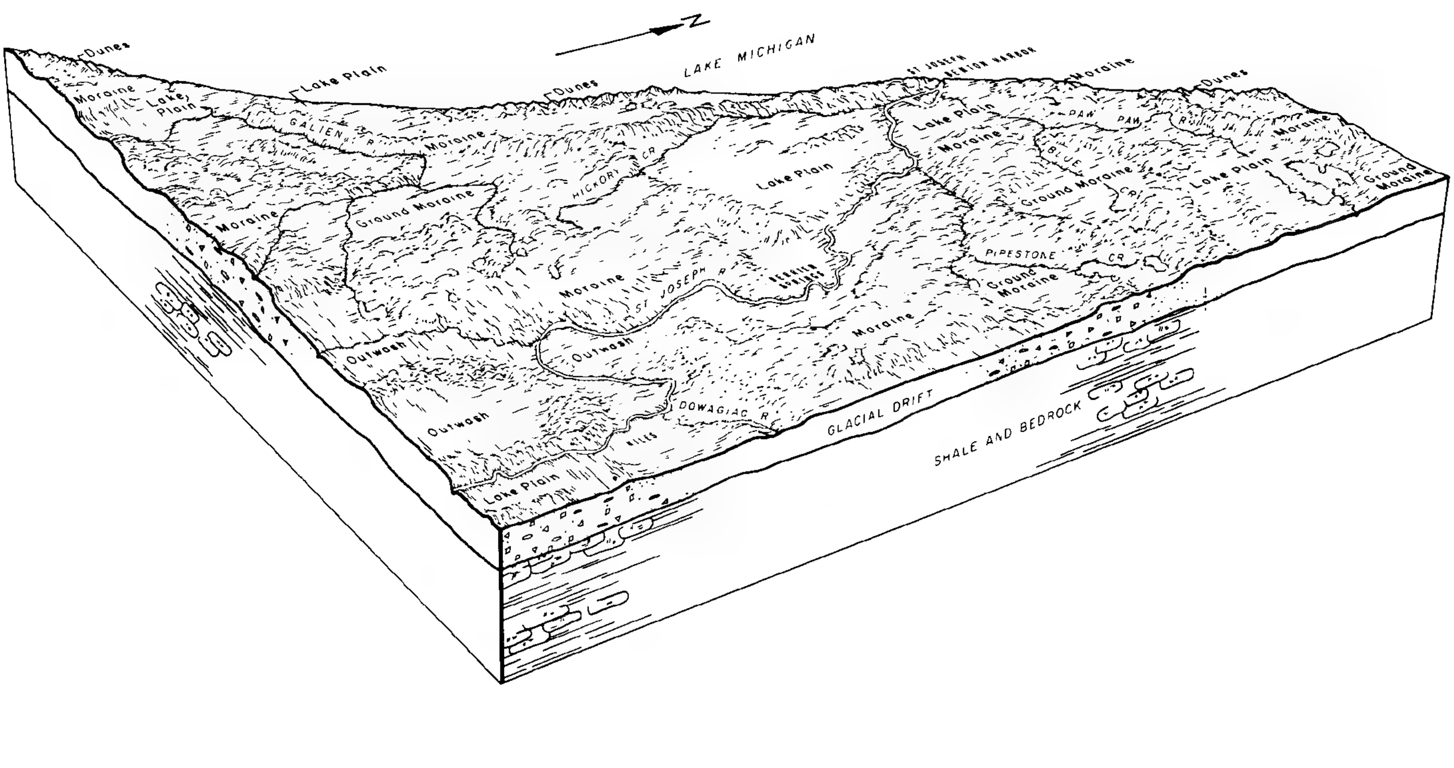

Figure 4.—Physiography of Berrien County, Michigan.

division consists of a broad plateaulike highland. In places there is an abrupt front facing the lake plains to the west. This area ranges from 100 to more than 300 feet above Lake Michigan. The Valparaiso Terminal Moraine, till plains, and outwash aprons from these morainic deposits comprise the surface features of this physiographic division. These features are dissected and modified by the terraces and valley train features of the St. Joseph River system. The morainal areas consist of deep basins and sharp slopes. The sloping areas are well drained, the level areas are somewhat poorly drained, and the kettle holes are poorly drained. The surface drainage is deranged. The outwash plains are smooth, except where diversified by swamps, kettle holes, and stream valleys. These areas are mainly internally drained. They are well drained on the rises and somewhat poorly drained and poorly drained in the swales and depressions.

Narrow terrace plains on benches extend up the St. Joseph and Paw Paw Rivers and are graded to former lake levels. The surfaces are smooth and are not indented by kettle depressions or lakes. These benches terminate in sharp slopes or escarpments.

lakes and streams

Berrien County has 42 miles of Lake Michigan shoreline and 86 inland lakes. Paw Paw Lake is a major natural inland lake in Coloma and Watervliet Townships. Grand Mere Lakes in Lincoln Township, Little Paw Paw Lake in Coloma Township, Clear Lake in Buchanan Township, and Smith Lakes in Berrien Township are each about 160 acres. The other lakes are smaller than 160 acres.

Lake Chapin, a large manmade reservoir on the St. Joseph River, is the Oronoko-Berrien Township boundary. There are many smaller reservoirs that are privately owned.

There are three rivers in the county. The St. Joseph River, which is navigable to the dam at Berrien Springs, flows northwesterly through the county; the Paw Paw River, in the northern part, flows southwesterly; and the Galien River, in the southern part, flows southwesterly. There are five major creeks in the county. Blue Creek, in the northern part, flows westerly; Hickory Creek, in the middle part, flows northerly; Pipestone Creek, in the middle part, flows westerly; McCoy Creek, in the southern part, flows northeasterly; and Dowagiac Creek, in the eastern part, flows southwesterly. Many streams are stocked with salmon and trout.

how this survey was made

Soil scientists made this survey to learn what soils are in the survey area, where they are, and how they can be used. They observed the steepness, length, and shape of slopes; the size of streams and the general pattern of drainage; the kinds of native plants or crops; and the kinds of rock. They dug many holes to study soil profiles. A profile is the sequence of natural layers, or horizons, in a soil. It extends from the surface down into the parent material, which has been changed very little by leaching or by plant roots.

The soil scientists recorded the characteristics of the profiles they studied and compared those profiles with others in nearby counties and in more distant places. They classified and named the soils according to nationwide uniform procedures. They drew the boundaries of the soils on aerial photographs. These photographs show trees, buildings, fields, roads, and other details that help in drawing boundaries accurately. The soil maps at the back of this publication were prepared from aerial photographs.

The areas shown on a soil map are called map units. Most map units are made up of one kind of soil. Some are made up of two or more kinds. The map units in this survey area are described under "General soil map units" and "Detailed soil map units."

While a soil survey is in progress, samples of some soils are taken for laboratory measurements and for engineering tests. All soils are field tested to determine their characteristics. Interpretations of those characteristics may be modified during the survey. Data are assembled from other sources, such as test results, records, field experience, and state and local specialists. For example, data on crop yields under defined management are assembled from farm records and from field or plot experiments on the same kinds of soil.

But only part of a soil survey is done when the soils have been named, described, interpreted, and delineated on aerial photographs and when the laboratory data and other data have been assembled. The mass of detailed information then needs to be organized so that it can be used by farmers, woodland managers, engineers, planners, developers and builders, home buyers, and others.

general soil map units

The general soil map at the back of this publication shows broad areas that have a distinctive pattern of soils, relief, and drainage. Each map unit, or association, on the general soil map is a unique natural landscape. Typically, an association consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one association can occur in other associations but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one association differ from place to place in slope, depth, drainage, and other characteristics that affect management.

1. Spinks-Oakville-Oshtemo association

Nearly level to very steep, well drained, sandy and loamy soils on moraines, till plains, outwash plains, and beach ridges

This association makes up 18 percent of the county. It is about 45 percent Spinks soils, 20 percent Oakville soils, 15 percent Oshtemo soils, and 20 percent soils of minor extent.

In most places, Oakville soils are on higher elevations than Spinks and Oshtemo soils. They are on slightly higher knolls, ridges, and hills. Generally, Spinks and Oshtemo soils are on slightly lower, sloping areas. Spinks and Oakville soils have low available water capacity and are droughty.

Spinks soils are nearly level to strongly sloping and well drained. The surface layer is dark brown loamy fine sand about 10 inches thick. The subsurface layer is light yellowish brown fine sand about 6 inches thick. The next layer is brownish yellow and light brown, loose fine sand with thin strata of dark brown, very friable sand or loamy fine sand to a depth of about 60 inches.

Oakville soils are nearly level to very steep and well drained. The surface layer is very dark grayish brown fine sand about 3 inches thick. The subsurface layer is brown fine sand about 7 inches thick. The subsoil, about 17 inches thick, is yellowish brown, loose fine sand. The underlying material is very pale brown fine sand to a depth of about 60 inches.

Oshtemo soils are nearly level to steep and well drained. The surface layer is dark grayish brown sandy loam about 8 inches thick. The subsurface layer, about 2 inches thick, is dark yellowish brown loamy fine sand. The subsoil is 50 inches thick. The upper part is dark brown and dark reddish brown, friable sandy loam; the middle part is dark brown, very friable loamy sand; and the lower part is yellowish brown, loose sand with thin strata of dark brown, loose loamy sand.

Of minor extent are the excessively drained Plainfield soils; the well drained Tustin soils; and the somewhat poorly drained Morocco, Pipestone, and Thetford soils. The Plainfield and Tustin soils are commonly adjacent to the major soils in the association. Morocco, Pipestone, and Thetford soils are in the lower drainageways and shallow depressions on the landscape.

Most of the soils in this association are farmed. Specialty crops, such as peaches and cherries, are generally grown on soils that have slopes of 0 to 12 percent. If slopes are more than 12 percent, most of the land is idle or in woodland. Soil blowing and droughtiness are concerns in cultivated areas.

The soils in this association are well suited to hay, pasture, woodland, and recreation uses. They are poorly suited to cultivated crops. Many areas of this association can be irrigated. With proper management, these areas can be productive. This association is fairly suited to building site developments and septic tank absorption fields. Slope and poor filtering capacity of the soils are the main limitations.

2. Blount-Rimer association

Nearly level and gently sloping, somewhat poorly drained, loamy and sandy soils on till plains and moraines

This association makes up 18 percent of the county. It is about 40 percent Blount soils, 20 percent Rimer soils, and 40 percent soils of minor extent.

Blount soils are nearly level or gently sloping and somewhat poorly drained. The surface layer typically is dark grayish brown loam about 9 inches thick. The mottled subsoil is about 25 inches thick. The upper part is yellowish brown, firm silty clay loam; the lower part is dark yellowish brown, firm clay. The underlying material is yellowish brown, mottled clay loam to a depth of about 60 inches.

Rimer soils are nearly level or gently sloping and somewhat poorly drained. The surface layer typically is

very dark grayish brown loamy fine sand about 9 inches thick. The mottled subsurface layer, about 23 inches thick, is pale brown and yellowish brown, loamy fine sand or fine sand. The subsoil, about 9 inches thick, is gray, firm clay. The underlying material is yellowish brown, mottled clay to a depth of about 60 inches.

Of minor extent are the poorly drained Belleville, Lenawee, and Pewamo soils; the somewhat poorly drained Kibbie, Morocco, Selfridge, and Thetford soils; the moderately well drained Glynwood soils; and the well drained Tustin soils. The Belleville, Lenawee, and Pewamo soils are in drainageways and lower shallow depressions on the landscape. Kibbie, Morocco, Selfridge, and Thetford soils are in positions on the landscape similar to those of the major soils in this association. Glynwood soils are on the side slopes and ridgetops. The Tustin soils are on the higher crest of knolls and on the ridges along the banks of steeply dissected rivers and streams.

Most of the soils in this association have been cleared and drained. They are used for cultivated crops that are common in the county and for hay and pasture. Orchards and vineyards are common. There are some swampy, undrained areas. Wetness and restricted permeability are the main limitations.

If adequately drained, the soils in this association are well suited to cultivated farm crops. They are well suited to hay, pasture, and woodlands. These soils are poorly suited to building site developments and septic tank absorption fields. A high water table is the main limitation.

3. Morocco-Thetford-Granby association

Nearly level, somewhat poorly drained and poorly drained, sandy soils on moraines, till plains, outwash plains, lake plains, and beach ridges

This association makes up about 10 percent of the county (fig. 5). It is about 25 percent Morocco soils, 25 percent Thetford soils, 12 percent Granby soils, and 38 percent soils of minor extent.

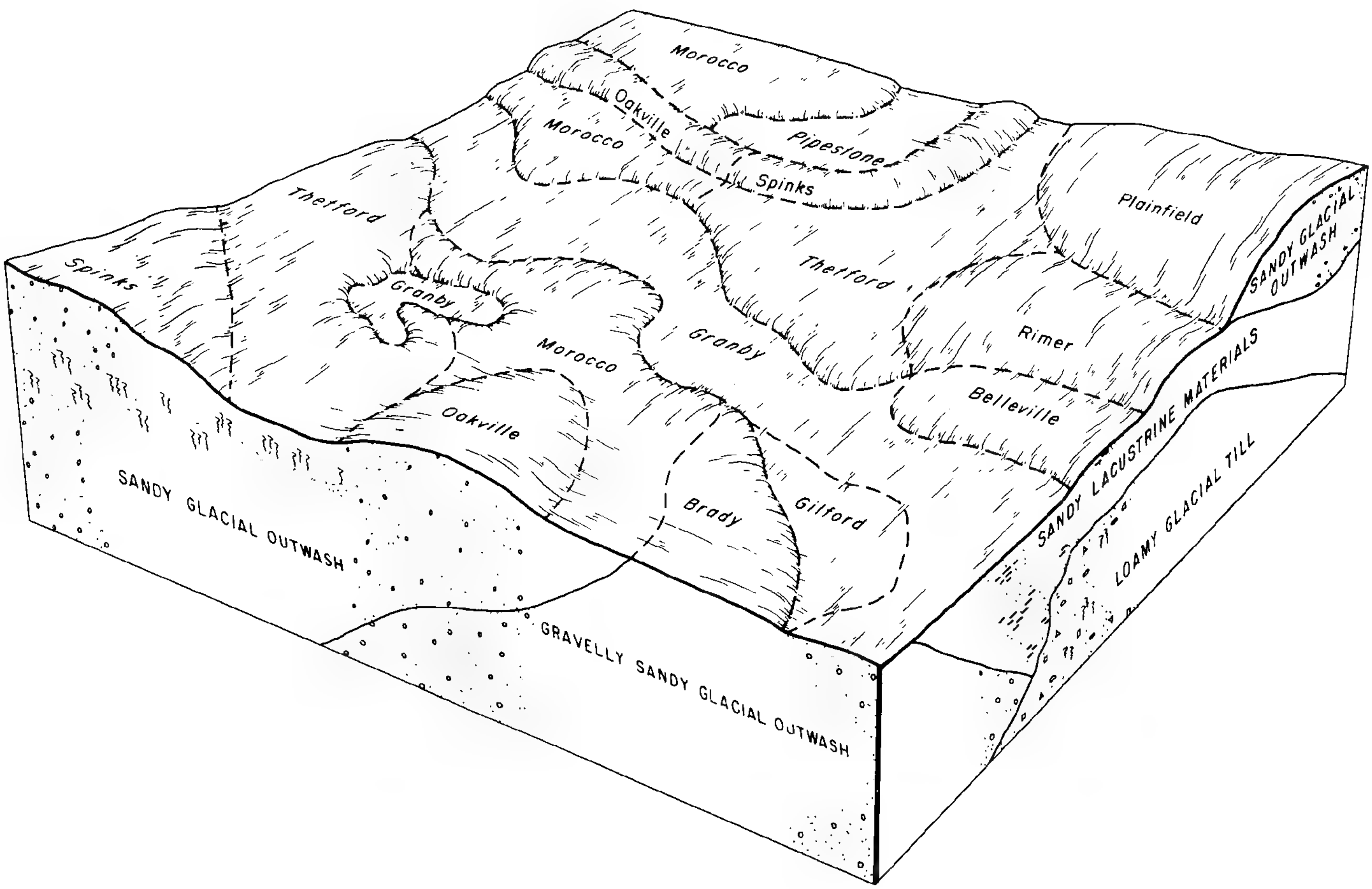

Figure 5.—Pattern of soils and underlying material in the Morocco-Thetford-Granby association.

The Morocco and Thetford soils are on higher elevations than the Granby soils that are on low flat plains and in drainageways and depressions. All of these soils have rapid or moderately rapid permeability, a sandy surface layer, and a seasonal high water table.

Morocco soils are nearly level and somewhat poorly drained. The surface layer is very dark grayish brown loamy sand about 9 inches thick. The subsurface layer is pale brown, mottled sand about 8 inches thick. The yellowish brown, mottled, loose sand subsoil is about 18 inches thick. The underlying material is light brownish gray, mottled sand to a depth of about 60 inches.

Thetford soils are nearly level and somewhat poorly drained. Typically, the surface layer is dark brown loamy sand about 10 inches thick. The next layer, to a depth of about 31 inches, is brownish yellow and very pale brown, mottled fine sand. Below that is pale brown, mottled, fine sand with thin layers of yellowish brown loamy fine sand to a depth of about 60 inches.

Granby soils are nearly level and poorly drained. Typically, the surface layer is very dark brown loamy fine sand about 12 inches thick. The grayish brown and light brownish gray, mottled fine sand subsoil is about 34 inches thick. The underlying material is multicolored fine sand to a depth of about 60 inches.

Of minor extent are the very poorly drained Gilford soils and the poorly drained Belleville soils. These soils are generally in shallow depressions and drainageways. The somewhat poorly drained Brady, Pipestone, and Rimer soils are in positions on the landscape similar to those of the Morocco and Thetford soils. The excessively drained Plainfield soils and the well drained Spinks and Oakville soils are on the higher ridges and knolls.

Most of the soils in this association are farmed. The rest are used as woodland or are idle. Management problems are removing excess water, controlling soil blowing, maintaining soil fertility, and conserving moisture during midsummer months.

The soils in this association are fairly suited to cultivated crops and well suited to specialty crops, such as blueberries, grapes, and asparagus. These soils are well suited to hay and pasture. They are fairly to poorly suited to trees. These soils are poorly suited to building site developments and septic tank absorption fields. Wetness, caving of cutbanks, and poor filtering capacity of the soils are the main limitations. Ponding is a hazard on the Granby soils.

4. Riddles-Ockley-Oshtemo association

Nearly level to very steep, well drained, loamy soils on outwash plains, moraines, and till plains

This association makes up 22 percent of the county (fig. 6). It is about 35 percent Riddles soils, 15 percent Ockley soils, 15 percent Oshtemo soils, and 35 percent soils of minor extent.

In most places, the Oshtemo soils are on lower elevations than the Riddles and Ockley soils. The Ockley and Oshtemo soils are commonly in broad, flat areas. In many areas, they are adjacent on the same slope.

Riddles soils are gently sloping to very steep and well drained. The surface layer is dark brown loam about 7 inches thick. The dominantly yellowish brown, friable or firm, sandy clay loam subsoil is about 48 inches thick. The underlying material is dark yellowish brown, mottled loam to a depth of about 63 inches.

Ockley soils are nearly level to strongly sloping and well drained. The surface layer is dark grayish brown loam about 9 inches thick. The dominantly brown subsoil is about 43 inches thick. The upper part is gravelly clay loam; the middle part is gravelly sandy clay loam, sandy loam, and gravelly sandy clay loam; and the lower part is loamy sand. The underlying material is dark yellowish brown gravelly coarse sand to a depth of about 60 inches.

Oshtemo soils are nearly level to steep and well drained. The surface layer is dark grayish brown sandy loam about 8 inches thick. The subsurface layer, about 2 inches thick, is dark yellowish brown loamy fine sand. The subsoil is about 50 inches thick. The upper part is dark brown and dark reddish brown, friable sandy loam; the middle part is dark brown, very friable loamy sand; and the lower part is yellowish brown, loose sand with thin strata of dark brown, loose loamy sand.

Of minor extent are the well drained Martinsville and Spinks soils. They are in positions on the landscape similar to those of the major soils. The somewhat poorly drained Brady, Crosier, and Monitor soils are on lower concave foot slopes and in depressions and drainageways. The very poorly drained Houghton and Rensselaer soils are in the swamps, drainageways, depressions, and potholes on the uplands. The poorly drained Cohoctah soils are on the bottom lands of streams.

Most of the soils in this association are farmed. Where the slopes are steep, these soils are used as woodland. Orchards and vineyards cover a large area of these soils. The main problem in cultivated areas is erosion.

The Riddles and Ockley soils are well suited to cultivated crops and specialty crops. The Oshtemo soils are fairly suited to hay, pasture, recreation, and woodlands and are well suited to specialty crops, such as peaches and cherries.

Riddles and Ockley soils generally are fairly suited to well suited to septic tank absorption fields in areas where slopes are less than 12 percent. Oshtemo soils and other soils that have slopes of more than 12 percent are poorly suited to septic tank absorption fields. Oshtemo soils have poor filtering capacity. These soils are fairly to well suited to building site developments. Slope, shrink-swell potential, and low strength are the main limitations for building site developments.

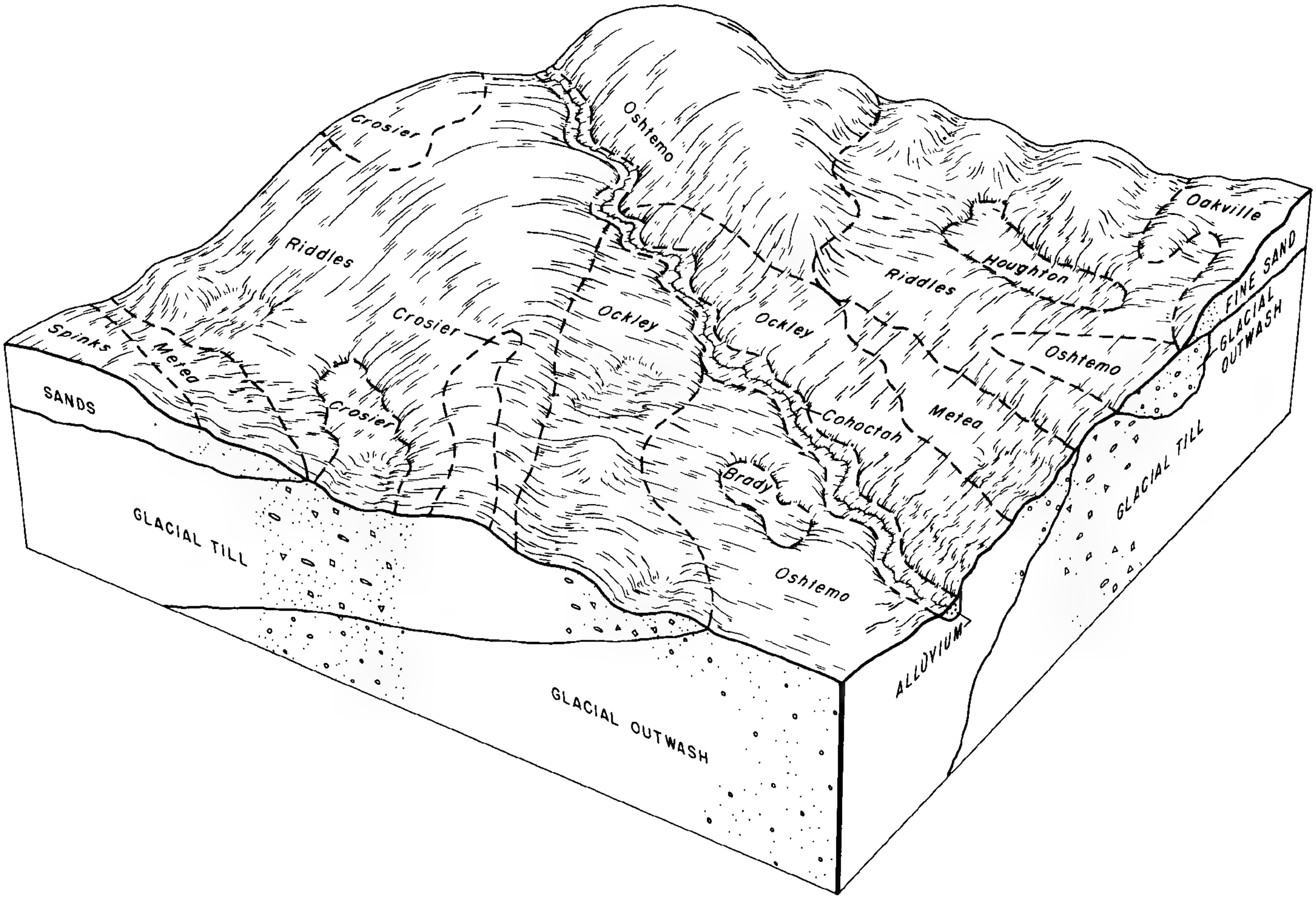

Figure 6.—Pattern of soils and underlying material in the Riddles-Ockley-Oshtemo association.

5. Shoals-Cohoctah-Abscota association

Nearly level and gently sloping, poorly drained to moderately well drained, silty and loamy soils on flood plains

This association makes up 2 percent of the county (fig. 7). It is about 30 percent Shoals soils, 30 percent Cohoctah soils, 25 percent Abscota soils, and 15 percent soils of minor extent.

Areas of these soils are on bottom lands, flood plains, or terraces along rivers and streams. The Cohoctah soils are on lower elevations than the Shoals and Abscota soils. The Abscota soils are on higher elevations than the Shoals and Cohoctah soils. All of these soils are subject to flooding.

Shoals soils are nearly level and somewhat poorly drained. The surface layer is dark grayish brown silt loam about 9 inches thick. The underlying material is multicolored, stratified silt loam, loamy fine sand, fine sandy loam, and loamy fine sand to a depth of about 60 inches.

Cohoctah soils are nearly level and poorly drained. The surface soil is very dark grayish brown and very dark gray sandy loam about 15 inches thick. The mottled underlying material is mostly dark gray silt loam in the upper part and very dark gray fine sandy loam in the lower part to a depth of about 60 inches.

Abscota soils are nearly level to gently sloping and moderately well drained. The surface layer is dark brown sandy loam about 10 inches thick. The mottled, loose sand subsoil is about 29 inches thick. The upper part is light gray, and the lower part is pale brown. The underlying material is multicolored sand to a depth of about 60 inches.

Of minor extent are the very poorly drained Houghton and Kerston mucks in shallow depressions, drainageways, and former stream channels in the flood plains. The well drained Oshtemo soils and the

moderately well drained Landes Variant soils are on low, flat knolls and ridges on the higher elevations of the flood plains.

Most areas of the Shoals and Abscota soils are farmed. Some areas are left idle or are in woodland. The Cohoctah soils are mainly idle or in woodland, with few areas farmed. The main problems are excess water, and soil blowing when cultivated.

The Shoals and Abscota soils are well suited to hay, pasture, and trees. The Shoals soils are well suited to cultivated crops. The Abscota soils are fairly suited to cultivated crops and some recreation uses. Shoals soils are fairly suited to poorly suited to recreation uses. Cohoctah soils are poorly suited to cultivated crops, hay, pasture, and recreation uses and are well suited to woodland. The soils in this association are poorly suited to building site developments and septic tank absorption fields because of flooding.

6. Pella-Kibbie association

Nearly level, poorly drained and somewhat poorly drained, silty and loamy soils on outwash plains, lake plains, and deltas

This association makes up 5 percent of the county (fig. 8). It is about 35 percent Pella soils, 30 percent Kibbie soils, 15 percent Lenawee soils, and 20 percent soils of minor extent.

In most places the Kibbie soils are on higher elevations than the Pella soils. Pella soils are on broad, flat areas and in drainageways. Both have a seasonal high water table.

Pella soils are nearly level and poorly drained. The surface layer is black silt loam about 11 inches thick. The subsoil is gray or grayish brown, mottled, firm silty clay loam about 21 inches thick. The underlying material to a depth of about 60 inches is 5 inches of gray silty clay loam, 19 inches of stratified loam and silty clay loam, and 4 inches of stratified loamy sand and silt loam.

Kibbie soils are nearly level and somewhat poorly drained. The surface layer is very dark grayish brown loam about 9 inches thick. The yellowish brown, mottled subsoil is about 23 inches thick. The upper part is friable silt loam, and the lower part is firm silty clay loam. The mottled underlying material is light yellowish brown silty clay loam, silt loam, silt, and very fine sand to a depth of about 60 inches.

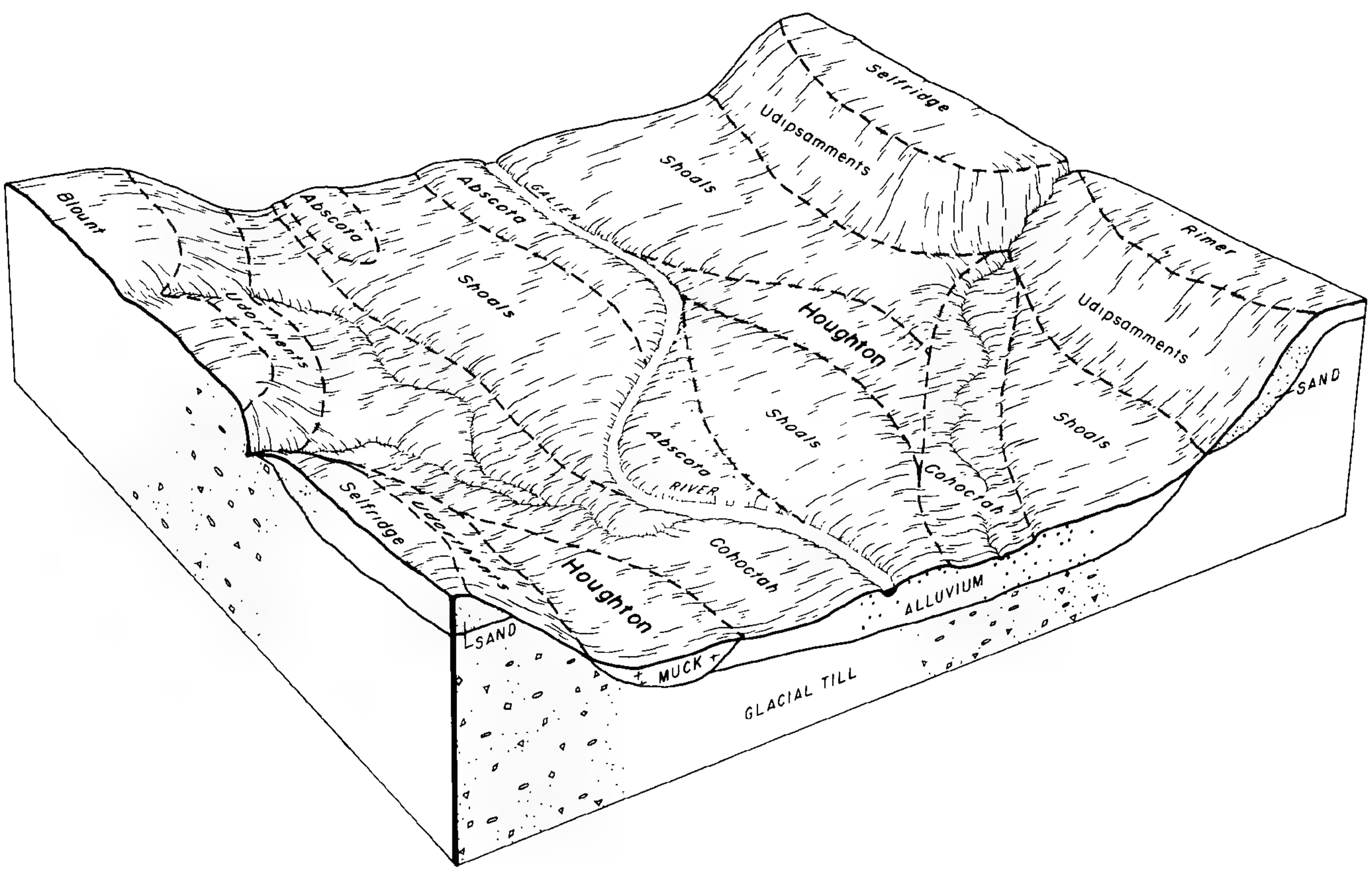

Figure 7.—Pattern of soils and underlying material in the Shoals-Cohoctah-Abscota association.

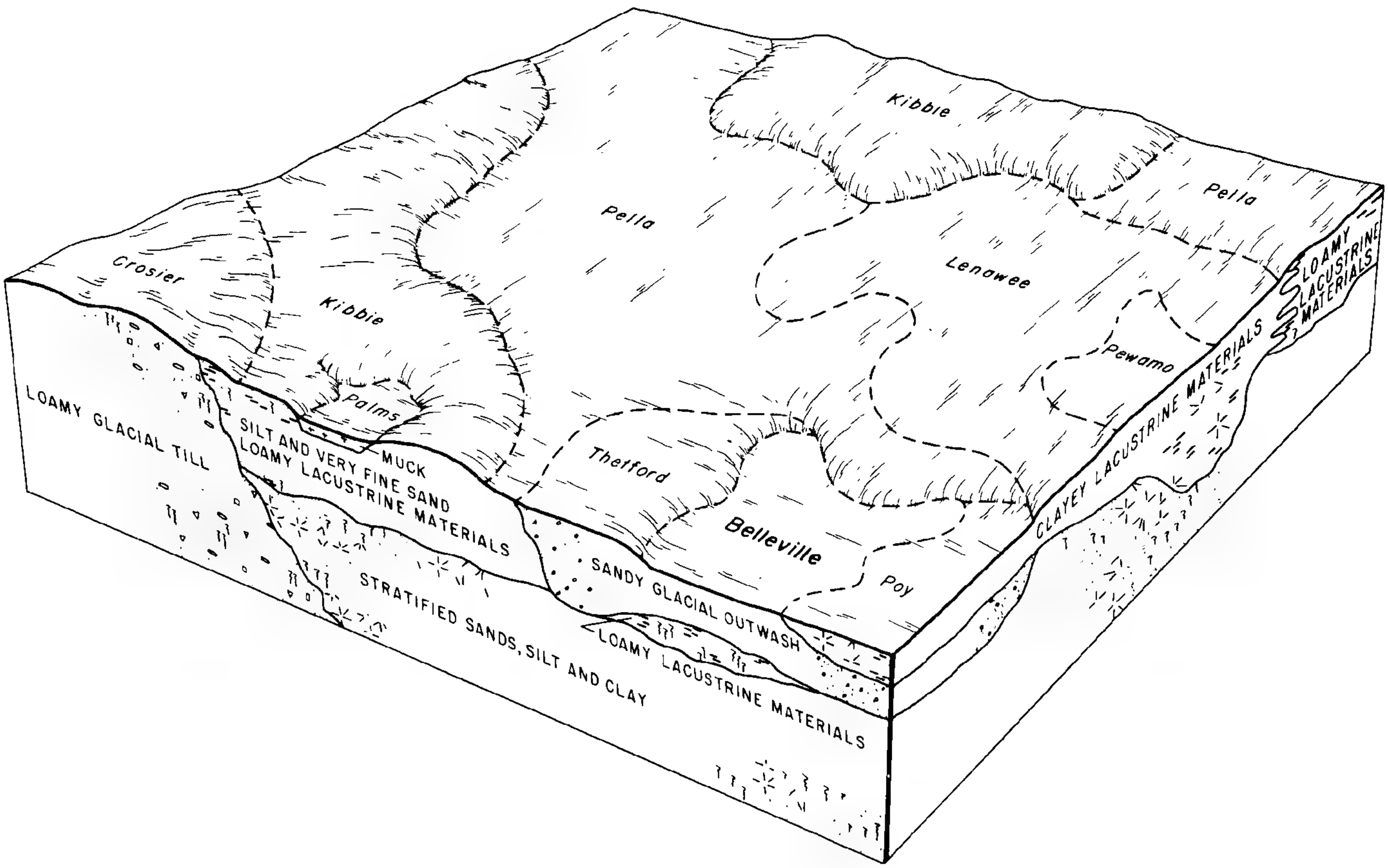

Figure 8.—Pattern of soils and underlying material in the Pella-Kibbie association.

Of minor extent is the very poorly drained Palms muck that formed in slightly depressed and ponded areas. The poorly drained Poy, Belleville, Lenawee, and Pewamo soils are in positions on the landscape similar to those of the Pella soils. The somewhat poorly drained Blount, Crosier, Whitaker, and Thetford soils are in positions on the landscape similar to the Kibbie soils.

Most of the soils in this association are farmed. Some areas are left idle or are in woodland. Wetness is the main limitation. Ponding is common in the lowest areas.

The soils in this association are well suited to cultivated crops, hay, and pasture. The Kibbie soils are well suited to trees, and the Pella soils are fairly suited to trees. The Kibbie soils are fairly suited to recreation uses. Pella soils are poorly suited to recreation uses. The soils in this association are poorly suited to building site developments and septic tank absorption fields. Wetness is the main limitation for Kibbie soils, and ponding is a hazard on Pella soils.

7. Brady-Monitor-Gilford association

Nearly level, somewhat poorly drained and very poorly drained, loamy soils on outwash plains, deltas, and lake plains

This association makes up 7 percent of the county. It is about 35 percent Brady soils, 15 percent Monitor soils, 15 percent Gilford soils, and 35 percent soils of minor extent.

In most places, the Gilford soils are on lower elevations than the Brady and Monitor soils. They are on broad, flat areas and in drainageways. All of these soils have a seasonal high water table.

Brady soils are nearly level and somewhat poorly drained. The surface layer is very dark grayish brown sandy loam about 11 inches thick. The mottled subsoil is about 37 inches thick. The upper part is pale brown, friable sandy loam; the middle part is strong brown, friable sandy loam; and the lower part is gray, stratified,

friable loam and loamy sand. The underlying material is grayish brown or brown sand to a depth of about 60 inches.

Monitor soils are nearly level and somewhat poorly drained. The surface layer is very dark grayish brown loam about 9 inches thick. The mottled, friable subsoil is about 46 inches thick. The upper part is grayish brown silt loam; the middle part is dark yellowish brown sandy clay loam and dark brown clay loam; and the lower part is dark yellowish brown sandy loam. The mottled underlying material is grayish brown loamy sand to a depth of about 60 inches.

Gilford soils are nearly level and very poorly drained. The surface layer is very dark gray sandy loam about 11 inches thick. The mottled subsoil is about 27 inches thick. The upper part is dark gray, friable fine sandy loam and sandy loam, and the lower part is grayish brown, very friable loamy sand. The underlying material is light brownish gray sand to a depth of about 60 inches.

Of minor extent are the poorly drained Granby and Sebewa soils that are in positions on the landscape similar to those of the Gilford soils. The somewhat poorly drained Thetford soils are in positions on the landscape similar to those of the Monitor soils. The well drained Coupee and Oshtemo soils are on higher knolls or ridge crests on the landscape.

Most of the soils in this association are farmed. The main problems of management are excess water, soil blowing, and droughtiness.

Brady and Monitor soils are well suited to hay, pasture, and some specialty crops, such as tomatoes and cucumbers. Monitor soils are well suited to cultivated crops and trees. Gilford soils are well suited to hay and pasture crops. Brady and Gilford soils are fairly suited to cultivated crops and trees. Gilford soils are fairly suited to specialty crops, such as blueberries, grapes, and tomatoes. The soils in this association are poorly suited to most types of recreation uses. These soils are poorly suited to building site developments and septic tank absorption fields. Wetness is the main limitation. Poor filtering capacity is also a problem on the Brady and Gilford soils.

8. Ockley-Oshtemo association

Nearly level to steep, well drained, loamy soils on outwash plains and moraines

This association makes up 18 percent of the county. It is about 30 percent Ockley soils, 30 percent Oshtemo soils, and 40 percent soils of minor extent.

In most places, the Ockley soils are on the higher elevations on the landscape. Oshtemo soils are generally on lower elevations or on steep side slopes along rivers and streams. In many areas, both are adjacent on the same slope.

Ockley soils are nearly level to strongly sloping and well drained. The surface layer is dark grayish brown loam about 9 inches thick. The dominantly dark brown subsoil is about 43 inches thick. The upper part is gravelly clay loam; the middle part is gravelly sandy clay loam and sandy loam; and the lower part is loamy sand. The underlying material is dark yellowish brown gravelly coarse sand to a depth of about 60 inches.

Oshtemo soils are nearly level to steep and well drained. The surface layer is dark grayish brown sandy loam about 8 inches thick. The subsurface layer, about 2 inches thick, is dark yellowish brown loamy fine sand. The subsoil is about 50 inches thick. The upper part is dark brown and dark reddish brown, friable sandy loam; the middle part is dark brown, very friable loamy sand; and the lower part is yellowish brown, loose sand with thin strata of dark brown, loose loamy sand.

Of minor extent are the excessively drained Plainfield soils and the well drained Riddles and Spinks soils. They are in positions on the landscape similar to those of the Ockley and Oshtemo soils. The somewhat poorly drained Brady, Monitor, and Thetford soils are in depressions and natural drainageways and on foot slopes. The well drained Coupee soils, in the southern part of the county, are on broad, flat plains that have dark surfaces. The very poorly drained Gilford soils and the poorly drained Sebewa soils are in shallow depressions and drainageways.

Most of the soils in this association are farmed. The main problems of management are erosion control, slope, and soil blowing. Droughtiness is a problem on the Oshtemo soils during the midsummer months.

The soils in this association are well suited to hay, pasture, specialty crops, and trees. Ockley soils are well suited to cultivated crops on slopes as much as 6 percent and fairly suited on slopes as much as 18 percent. Oshtemo soils are fairly suited to cultivated crops on 0 to 12 percent slopes. The soils in this association are fairly suited to well suited to recreation uses, building site developments, and septic tank absorption fields. Slope and poor filtering capacity are the main limitations for Oshtemo soils. Slope and shrink-swell potential are the main limitations on the Ockley soils.

broad land use considerations

Each year a considerable amount of land is being developed for residential use throughout the county. The general soil map is most helpful in planning the general locations for residential development. It cannot be used for the selection of sites for specific residential or urban structures. In general, in the survey area, the soils that have good potential for specialty crops and cultivated crops also have good potential for residential development. The data about specific soils in this survey can be helpful in planning future land use patterns.

Areas where the soils have severe limitations for residential and other urban developments are extensive. Large areas of the soils in the Blount-Rimer association and the Brady-Monitor-Gilford association have a seasonal high water table. The high water table is a severe limitation for building site developments. The more sloping areas of soils in the Spinks-Oakville-Oshtemo association, the Riddles-Ockley-Oshtemo association, and the Ockley-Oshtemo association also have severe limitations for building site developments.

There are also large areas of soils in the county that can be developed for urban uses. These include the less sloping areas of soils in the Spinks-Oakville-Oshtemo association, the Riddles-Ockley-Oshtemo association, and the Ockley-Oshtemo association. The soils in the Riddles-Ockley-Oshtemo association have the best potential for use as cropland, and this potential should not be overlooked when broad land uses are considered (fig. 9).

The less sloping, well drained soils of the Riddles-Ockley-Oshtemo association that have good air drainage are uniquely suited to tree fruits, such as peaches and cherries. Also, grape site indexes are higher on the soils in this association. The less sloping, well drained soils of the Spinks-Oakville-Oshtemo association are well suited to asparagus production. The somewhat poorly drained and poorly drained soils of the Morocco-Thetford-Granby association and the Brady-Monitor-Gilford association are well suited to blueberries and tomato production.

Most of the soils of the county have good or fair potential for use as woodland. Notable exceptions are the soils of the Shoals-Cohoctah-Abscota association, which produce poor wood crops. Commercially valuable trees are less common and generally do not grow so rapidly on the wetter soils of the Pella-Kibbie-Lenawee association as they do on the soils in the other associations.

Figure 9.—Typical landscape of the Riddles-Ockley-Oshtemo association in Galien Township. Cover crops protect these soils from erosion, which would result in deposition of sediment onto the low-lying Houghton muck in the center.

The hilly areas of soils in the Riddles-Ockley-Oshtemo and Spinks-Oakville-Oshtemo associations have good potential as sites for parks and extensive recreation areas. Native hardwood woodlots enhance the beauty of these areas. Undrained marshes and swamps on all of these soils are suitable for use as nature study areas. All of the soils in these associations provide habitat for many species of wildlife.

detailed soil map units

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under "Use and management of the soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the underlying material, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the underlying material. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Oshtemo sandy loam, 0 to 6 percent slopes, is one of several phases in the Oshtemo series.

Some map units are made up of two or more major soils. These map units are called soil complexes.

A *soil complex* consists of two or more soils in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Oshtemo-Ockley complex, 0 to 4 percent slopes, is an example.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. The included soils are identified in each map unit description. Some small areas of strongly contrasting soils are identified by a special symbol on the soil maps.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Pits is an example. Miscellaneous areas are shown on the soil maps. Some that are too small to be shown are identified by a special symbol on the soil maps.

Table 5 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

2—Cohoctah-Abscota sandy loams. This map unit consists of the nearly level, poorly drained Cohoctah soil and the moderately well drained Abscota soil on flood plains and bottom lands of streams and rivers. Most areas are narrow, elongated flood plains in deeply dissected, upland drainageways. These soils are subject to flooding sometime during most years. Individual areas range from 5 to 150 acres. They are 55 to 70 percent Cohoctah soil and 15 to 25 percent Abscota soil. The Cohoctah soil is on the lowest elevation of old stream meanders and shallow channels. The Abscota soil is on the higher, convex knolls and rises and old stream terraces adjacent to the uplands. The two soils are so intricately mixed, or areas are so small in size, that it is not practical to separate them in mapping.

Typically, the Cohoctah soil has a surface layer of very dark grayish brown and very dark gray sandy loam about 15 inches thick. The mottled underlying material to a depth of about 60 inches is mostly dark gray silt loam in the upper part, very dark gray fine sandy loam in the middle part, and grayish brown loamy sand and fine sand in the lower part.

Typically, the Abscota soil has a surface layer of dark brown sandy loam about 10 inches thick. The mottled, loose sand subsoil is about 29 inches thick. The upper part is light gray; the lower part is pale brown. The mottled underlying material to a depth of about 60 inches is multicolored calcareous sand. In places the subsoil is thicker and is loam or the surface layer is loam.

Included with these soils in mapping are small areas of somewhat poorly drained Shoals and Brady soils, each making up 5 to 10 percent of the unit. Also included are small areas of moderately well drained Landes Variant and Oshtemo soils, each making up about 5 percent of the unit. The Shoals and Brady soils are on slightly

higher rises above the Cohoctah soil but are below the Abscota soil in the landscape. The Landes Variant and Oshtemo soils are in the same position in the landscape as the Abscota soil.

Permeability is moderately rapid in the Cohoctah soil and rapid in the Abscota soil. The available water capacity is high for the Cohoctah soil. The Abscota soil has low available water capacity. Surface runoff is slow for the Abscota soil and is very slow or ponded for the Cohoctah soil. The Cohoctah soil has a water table at a depth of 1 foot or less during the wet season. The Abscota soil has a water table at a depth of 2-1/2 to 5 feet during the winter and spring.

Most areas of these soils are in idle brushland, used as woodland, or used for pasture. The soils have poor potential for cultivated crops and specialty crops, pasture and hay, recreation uses, septic tank absorption fields, and building site developments. They have good potential for wetland or woodland wildlife habitats.

These soils are not generally cultivated because of flooding and general wetness of the areas. The uneven, dissected surface relief and inaccessibility also limit the use of these soils. A few areas are cultivated, mostly to corn or soybeans.

If these soils are used for pasture, proper stocking, pasture rotation, and restricted use during wet periods are needed. Grasses that can tolerate wet conditions should be planted. Pasture commonly is damaged each year by flooding and frost heaving. Tile drainage and flood protection devices help reduce damage to pasture.

These soils are suited to trees. Equipment limitations, seedling mortality, and windthrow hazard are major management concerns for the Cohoctah soil. This soil has an expected loss of more than 50 percent of planted seedlings. The Abscota soil has an expected loss of 25 to 50 percent, and trees are seldom blown down during storms. For the Cohoctah soil, woodland operations should be conducted during seasons when the soils are relatively dry or frozen. Special site preparations, such as bedding, are needed in some areas. Harvest methods that do not leave trees standing alone or widely spaced should be selected.

Building site developments and septic tank absorption fields are not practical on these soils. The high water table and flooding are limitations that are extremely difficult to overcome.

These soils are in capability subclass Vw and Michigan soil management groups L-2c, L-4a.

3—Beaches. This map unit consists of nearly level and gently sloping areas of fresh sand deposits. These sand deposits have been washed and rewashed by waves and are covered with water during storms. Ice builds up during winter storms. The sand is along the shores of Lake Michigan.

Typically, this land is fine sand on the surface and becomes coarser textured with increasing depth. Beaches support little or no vegetation. Recreation is the main use.

This map unit is in capability unit VIIIs.

4—Dune land. This map unit consists of gently sloping to steep, sandy areas along the beach of Lake Michigan. These areas range from 10 to 80 acres. Most areas do not have a protective plant cover and are actively shifting. Areas that are stabilized have been so recently deposited that no soil profile has developed.

Dune land has very low available water capacity and is very droughty. Beachgrass grows in clumps, and some trees and woody shrubs grow in sheltered coves. Dune land is on higher elevations than the adjacent beaches and is not subject to flooding or ice build-up during winter storms.

Areas of Dune land are a good source of sand. Many areas are used for recreation.

This map unit is in capability unit VIIIs.

5—Houghton muck. This nearly level, very poorly drained soil is on irregularly shaped areas in swamps, along drainageways, and in depressions and potholes on the uplands. It is subject to frequent ponding. Individual areas range from 3 to 120 acres.

Typically, the surface layer is dark reddish brown muck about 8 inches thick. The underlying material is dark reddish brown or black, friable muck to a depth of 60 inches. Some areas of this soil have a peat layer in the subsoil. Some areas are less than 50 inches of muck over mineral material. In the southern part of the county, some areas of this soil are extremely acid.

Permeability is moderately slow to moderately rapid, and surface runoff is very slow. The available water capacity is high. The surface layer is friable and is easily tilled if the soil is not wet. The water table ranges from 1 foot above to 1 foot below the surface during most of the year.

Most areas of this soil are used for pasture or cultivated crops. Other areas are left idle, used as woodland, or left as wildlife habitat. This soil has fair potential for cultivated crops, such as corn and soybeans. It has good potential for specialty crops, such as potatoes and other shallow-rooted vegetables. It has good potential for pasture and hay crops. This soil has poor potential for woodland, recreation uses, septic tank absorption fields, and building site developments.

Houghton muck is used for corn, soybeans, and grasses for hay and pasture. This soil needs deep ditches and tile to remove the excess water. Good tile outlets are difficult to find in some areas. Drainage tile needs to be covered with straw, grass clippings, fiberglass, or other suitable material to help keep the tile free of sediment. Soil blowing is a major problem if the soil is cleared and left unprotected. Tree windbreaks, windstrips, and cover crops are beneficial conservation practices that reduce soil blowing.

Specialty crops, such as blueberries, can be grown on this soil. Excess water needs to be controlled by using deep ditches and underground drains. If drained, these

soils should be protected from blowing by using windbreaks.

Pasture or hay crops are effective in controlling soil blowing. Proper species selection and artificial drainage help forage crops to survive winter freezing. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during the wet months help to keep the pasture and soil in good condition.

This soil is poorly suited to use as woodland. The use of equipment for planting, tending, and harvesting trees is severely limited in kind and time of use. Woodland operations should be conducted during seasons when the soil is relatively dry or frozen. Expected loss of seedlings may be more than 50 percent. Special site preparations, such as bedding in some areas, should be used. Trees are often uprooted and blown down during storms. Harvest methods that do not leave trees standing alone or widely spaced should be used. Plans should be developed for periodic salvage of windthrown trees when needed. Unwanted shrubs and trees may delay natural regeneration of desirable trees unless sites are intensively prepared. Special harvest methods and site preparation may be needed to control undesirable plant competition.

Building site developments and septic tank absorption fields are not practical on this soil. The high water table, ponding, and low strength are limitations that are extremely difficult to overcome.

This soil is in capability subclass IIIw and Michigan soil management group Mc.

6—Adrian muck. This nearly level, very poorly drained soil is on irregularly shaped areas in swamps, along drainageways, and in depressions on the uplands. It is subject to frequent ponding. Individual areas range from 2 to 25 acres.

Typically, the surface layer is very dark brown muck about 5 inches thick. To a depth of about 26 inches is dark reddish brown and black muck. The underlying material is brown and gray, mottled, strongly acid fine sand and fine loamy sand to a depth of 60 inches. Some small areas that have less than 16 inches of muck are included in areas near the boundary of the map unit. In places, there are more than 50 inches of muck.

Permeability is moderately slow to moderately rapid in the muck material and rapid in the underlying sand material. Surface runoff is very slow. The available water capacity is high. The surface layer is friable and easily tilled if the soil is not wet. The water table ranges from 1 foot above to 1 foot below the surface during most of the year.

Most areas of this soil are left idle, used as woodland, or used as wildlife habitat. Some areas are cultivated or used for specialty crops, such as blueberries or shallow-rooted vegetables. This soil has fair potential for cultivated crops and good potential for pasture and hay. It has poor potential for woodland, recreation uses, septic tank absorption fields, and building site developments.

If drained, this soil is used for corn, soybeans, hay, and pasture. Deep ditches and tile are needed to remove excess water. Excessive subsidence of the shallow organic layers is a problem when the muck is drained. Tile needs to be covered with straw, grass clippings, fiberglass, or other suitable material to keep it free of sediment. Soil blowing is a major problem if this soil is cleared and left unprotected. Tree windbreaks, windstrips, and cover crops are beneficial conservation practices.

Specialty crops, such as blueberries and shallow-rooted vegetables, can be grown on this soil. Excess water needs to be controlled by using deep ditches and underground drains. If drained, these soils should be protected from soil blowing by using windbreaks.

Pasture or hay crops are effective in controlling soil blowing. Proper selection of species and artificial drainage help forage crops survive the winter freezing. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during the wet seasons help to keep the pasture and soil in good condition.

This soil is poorly suited to use as woodland. The use of equipment for planting, tending, and harvesting trees is severely limited in kind and time of use. Woodland operations should be conducted during seasons when the soil is relatively dry or frozen. Expected loss of seedlings is more than 50 percent. Special site preparations, such as bedding, are needed in some areas. Trees are often blown down during storms. Harvest methods that do not leave trees standing alone or widely spaced should be selected. Plans should be developed for periodic salvage of windthrown trees when needed. Unwanted shrubs and trees may delay natural regeneration of desirable trees unless sites are intensively prepared. Special harvest methods and site preparation may be needed to control undesirable plant competition.

Building site developments and septic tank absorption fields are not practical on this soil. The high water table, ponding, and low strength are limitations that are extremely difficult to overcome.

This soil is in capability subclass IVw and Michigan soil management group M/4c.

7—Palms muck. This nearly level, very poorly drained soil is on irregularly shaped areas in swamps, along drainageways, and in depressions on the uplands. It is subject to frequent ponding. Individual areas range from 3 to 70 acres.

Typically, the surface layer and subsurface layer are black, very dark brown, or very dark gray muck about 40 inches thick. The underlying material is gray, mottled clay loam to a depth of 60 inches. Some areas, near the boundary of the unit, have less than 16 inches of muck. In places, there are more than 50 inches of muck.

Permeability is moderately slow to moderately rapid in the muck material and moderate or moderately slow in the loamy underlying material. Surface runoff is very

slow. The available water capacity is high. The surface layer is friable and easily tilled if the soil is not wet. The water table ranges from 1 foot above to 1 foot below the surface during most of the year.

Most areas of this soil are farmed, used as woodland, or used for wildlife habitat. Many areas are cultivated or used for specialty crops, such as shallow-rooted vegetables and blueberries. Some areas are in pasture. This soil has good potential for cultivated crops, specialty crops, pasture, and hay. This soil has poor potential for woodland, recreation uses, septic tank absorption fields, and building site developments.

This soil is used for corn, soybeans, hay, and pasture. The main problems of management are wetness and soil blowing. This soil needs deep ditches and tile to remove the excess water. Good tile outlets are difficult to find in some areas. Drainage tile needs to be covered with straw, grass clippings, fiberglass, or other suitable material to keep the tile free of sediment. Soil blowing is a major problem if this soil is cleared and left unprotected. Tree windbreaks, windstrips, and cover crops are beneficial conservation practices.

Specialty crops, such as blueberries and shallow-rooted vegetables, can be grown on this soil. Excess water needs to be controlled by using deep ditches and underground drains. If drained, this soil should be protected from blowing by using windbreaks.

Pasture or hay crops are effective in controlling soil blowing. Proper species selection and artificial drainage help forage crops survive the winter freezing. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during the wet months help to keep the pasture and soil in good condition.

This soil is poorly suited to use as woodland. The use of equipment for planting, tending, and harvesting trees is severely limited in kind and time of use. Woodland operations should be conducted during seasons when the soil is relatively dry or frozen. Expected loss of seedlings is more than 50 percent. Special site preparations, such as bedding, are needed in some areas. Trees are often blown down during storms. Harvest methods that do not leave trees standing alone or widely spaced should be selected. Plans should be developed for periodic salvage of windthrown trees where needed. Unwanted shrubs and trees may delay natural regeneration of desirable trees unless sites are intensively prepared. Special harvest methods and site preparation may be needed to control undesirable plant competition.

Building site developments and septic tank absorption fields are not practical on this soil. The high water table, ponding, and low strength are limitations that are extremely difficult to overcome.

This soil is in capability subclass IIIw and Michigan soil management group M/3c.

10B—Oakville fine sand, 0 to 6 percent slopes. This nearly level and gently sloping, well drained soil is on convex ridgetops, knolls, and short, uneven side slopes. Individual areas are irregular in shape and range from 2 to 300 acres.

Typically, the surface layer is dark brown fine sand about 9 inches thick. The subsoil, about 25 inches thick, is yellowish brown, loose fine sand. The underlying material is very pale brown fine sand to a depth of about 60 inches. Some areas have thin bands of loamy fine sand in the subsoil.

Included with this soil in mapping are small areas of somewhat poorly drained Pipestone, Morocco, and Thetford soils. These soils are in shallow depressions and drainageways. Each makes up 5 to 10 percent of the unit but does not exceed 15 percent of any one delineated map unit.

Permeability of this Oakville soil is rapid or very rapid, and surface runoff is very slow. The available water capacity is low. The surface layer is loose and easily tilled.

Most areas of this soil are in cropland. This soil has fair potential for cultivated crops. It has good potential for hay or pasture, woodland, most specialty crops commonly grown in the county, and building site developments. It has fair potential for recreation uses and septic tank absorption fields.

This soil is suited to small grain, corn, and specialty crops if it is adequately fertilized and irrigated. The main problems of management are droughtiness and soil blowing. Small grain is better suited than corn because grain normally matures before the drier time of the year. If this soil is used for cultivated cr specialty crops, there is a hazard of soil blowing. Conservation tillage, mulch, cover crops, and windbreaks help to control excessive soil loss. Returning crop residue to the soil or regular addition of other organic material helps to improve fertility and available water capacity.

Specialty crops need additional water during the growing season. If the soil is irrigated and fertilized, production of peaches, cherries, strawberries, and tomatoes increases. Good air drainage helps to protect fruit from frost damage late in the growing season. Fruit crops need special and intensive management, such as controlling soil blowing and maintaining soil moisture by using cover crops and mulch. Other specialty crops grown on this soil are grapes and asparagus.

Pasture or hay crops are effective in controlling soil blowing. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during dry periods help to keep the pasture and soil in good condition.

This soil is well suited to use as woodland. Expected loss of planted or natural tree seedlings because of dry weather conditions can be in excess of 50 percent. Special harvest methods that leave some mature trees to provide shade and protection from the sun and wind may be needed. This soil has few, if any, hazards or limitations that affect the harvesting of trees.

This soil is suited to most building site developments. It is poorly suited to septic tank absorption fields and

sewage lagoons because of the poor filtering capacity and seepage. Caving cutbanks is a limitation for shallow excavations. Trench walls need to be reinforced to offset this limitation. Additional water and fertilizer are needed to establish lawns.

This soil is in capability subclass IVs and Michigan soil management group 5a.

10D—Oakville fine sand, 6 to 18 percent slopes. This sloping and strongly sloping, well drained soil is on convex slopes. Individual areas are irregular or elongated in shape and range from 5 to 80 acres.

Typically, the surface layer is dark brown fine sand about 9 inches thick. The subsoil, about 22 inches thick, is yellowish brown, loose fine sand. The underlying material is very pale brown fine sand to a depth of about 60 inches. Some areas have thin bands of loamy fine sand in the subsoil.

Included with this soil in mapping are small areas of somewhat poorly drained Pipestone, Morocco, and Thetford soils. These soils are in shallow depressions and drainageways. Each makes up 4 to 8 percent of the unit but does not exceed 15 percent of any one delineated map unit.

Permeability of this Oakville soil is rapid or very rapid. The available water capacity is low. Surface runoff is very slow. The surface layer is loose and easily tilled.

Most areas of this soil are in woodland or are idle. The soil has poor potential for cropland or pasture. It has fair potential for some specialty crops. It has good potential for woodland and wildlife habitat. This soil has poor potential for recreation uses, septic tank absorption fields, and most building site developments.

Specialty crops need additional water during the growing season. If soils are irrigated and fertilized, production of peaches increases. Equipment use is limited on the steeper slopes. Fruit crops need special and intensive management, such as controlling soil blowing and maintaining soil moisture by using cover crops and mulching. Other specialty crops are grapes and, in less sloping areas, asparagus.

This soil is well suited to the production of trees, and a few areas are in native hardwoods. Expected loss of planted or natural tree seedlings because of dry weather conditions can be in excess of 50 percent. Special harvest methods that leave some mature trees to provide shade and protection from the sun and wind may be needed.

This soil is poorly suited to building site developments, septic tank absorption fields, and sewage lagoons. Slope is a limitation for building site developments. Slope and poor filtering capacity are limitations for septic tank absorption fields, and seepage is a limitation for sewage lagoons. Slope can be offset by cutting and filling and by using retaining walls for building site developments. Local roads should be constructed on the contour as closely as possible. Because of seepage, sewage lagoons are generally not practical on this soil.

This soil is in capability subclass VIs and Michigan soil management group 5a.

10F—Oakville fine sand, 18 to 45 percent slopes. This moderately steep and very steep, well drained soil is on dunes, beach ridges, and moraines. Individual areas are irregular or elongated in shape and range from 5 to 520 acres.

Typically, the surface layer is very dark grayish brown fine sand about 3 inches thick. The subsurface layer is brown fine sand 7 inches thick. The subsoil is yellowish brown, loose fine sand about 17 inches thick. The underlying material is very pale brown fine sand to a depth of about 60 inches. Some places have thin bands of loamy fine sand in the subsoil.

Included with this soil in mapping are areas throughout the unit that have slopes of more than 45 percent. Also included are small areas of somewhat poorly drained Morocco soils that are in shallow depressions or drainageways and make up 2 to 4 percent of the unit.

Permeability of this Oakville soil is rapid or very rapid. The available water capacity is low. Surface runoff is very slow. The surface layer is loose.

Most areas of this soil are used as woodland or are left idle. The soil has poor potential for cultivated crops, pasture, most recreation uses, septic tank absorption fields, and building site developments. It has good potential for woodland and wildlife habitat.

This soil is suited to trees. Some areas are in native hardwoods. Erosion control measures, such as using ditches, culverts, waterbreaks, and crowning the road surface, are often needed. The use of heavy equipment for planting, tending, and harvesting trees is limited because of slope.

Building site developments, septic tank absorption fields, and sewage lagoons are not practical on this soil. Slope is a limitation that is extremely difficult to overcome.

This soil is in capability subclass VIIs and Michigan soil management group 5a.

11B—Oshtemo sandy loam, 0 to 6 percent slopes. This nearly level and gently sloping, well drained soil is on irregularly shaped convex areas. Individual areas range from 5 to 120 acres (fig. 10).

Typically, the surface layer is dark grayish brown sandy loam about 8 inches thick. The subsurface layer is dark yellowish brown loamy fine sand about 2 inches thick. The subsoil is about 50 inches thick. The upper part is dark brown and dark reddish brown, friable sandy loam; the middle part is dark brown, very friable loamy sand; and the lower part is yellowish brown, loose sand with thin strata of dark brown, loose loamy sand. In places, the subsoil has bands of loamy fine sand and

Figure 10.—Profile of Oshtemo sandy loam, 0 to 6 percent slopes, showing good horizon development below the surface layer (scale in feet).

fine sand. Some areas have a sand or loamy sand surface layer more than 20 inches thick.

Included with this soil in mapping are small areas of somewhat poorly drained Brady soils and well drained Ockley soils. The Brady soils are in natural waterways and depressions and make up 5 to 10 percent of the unit. The Ockley soils are on the same slopes as the Oshtemo soils and make up 5 to 10 percent of the unit. These inclusions do not exceed 15 percent of any one delineated map unit.

Permeability of this Oshtemo soil is moderately rapid in the upper part of the subsoil and very rapid in the lower part. Surface runoff is slow. The available water capacity is moderate. The surface layer is very friable and easily tilled.

Most areas of this soil are farmed. The soil has fair potential for cultivated crops and for septic tank absorption fields. It has good potential for pasture, hay, recreation uses, woodland, and building site development. The soil has good potential for specialty crops commonly grown in the county.

The main concerns of management are controlling soil blowing, conserving soil moisture, and maintaining soil fertility and content of organic matter. If used for cultivated or specialty crops, this soil should be fertilized and irrigated. Conservation tillage, mulch, and cover crops help to control excessive soil loss caused by soil blowing. Returning crop residue to the soil or regular addition of other organic material helps to improve fertility and the available water capacity.

Specialty crops need additional water during the growing season. Production of peaches, cherries, strawberries, and tomatoes increases if irrigation and fertilization are used. Good air drainage helps to protect fruit crops from frost damage late in the growing season. Fruit crops need special and intensive management, such as controlling blowing and maintaining soil moisture by using cover crops and mulch. Other specialty crops are apples, grapes, cucumbers, and asparagus.

Pasture or hay crops are effective in controlling soil blowing. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during dry periods help to keep the pasture and soil in good condition.

This soil is well suited to trees. A few small areas are in native hardwoods.

This soil is suited to building site developments. The poor filtering capacity is a severe limitation for septic tank absorption fields. Seepage is a limitation for sewage lagoons. Caving cutbanks is a limitation for shallow excavations. Trench walls should be reinforced to control this action. The bottom and sides of lagoons need to be covered with impervious material.

This soil is in capability subclass IIIs and Michigan soil management group 3a.

11C—Oshtemo sandy loam, 6 to 12 percent slopes. This sloping, well drained soil is on elongated or

irregularly shaped convex areas. Individual areas range from 5 to 70 acres.

Typically, the surface layer is dark brown sandy loam about 7 inches thick. The subsoil is about 40 inches thick. The upper part is dark brown and dark reddish brown, friable sandy loam; the middle part is dark brown, very friable loamy sand; and the lower part is yellowish brown, loose sand with thin strata of loamy sand. In places, the subsoil has bands of loamy fine sand and fine sand. Some areas have a sand or loamy sand surface layer more than 20 inches thick.

Included with this soil in mapping are small areas of somewhat poorly drained Brady and Thetford soils. These soils are in natural waterways and depressions. Each makes up 5 to 10 percent of the unit. These inclusions do not exceed 15 percent of any one delineated map unit.

Permeability of this Oshtemo soil is moderately rapid in the upper part of the subsoil and very rapid in the lower part. Surface runoff is slow. The available water capacity is moderate. The surface layer is very friable and easily tilled.

Many areas of this soil are farmed. Other areas are used as woodland or left idle. This soil has fair potential for cultivated crops and for septic tank absorption fields. It has good potential for pasture, hay, and woodland. It has fair potential for recreation uses and building site developments. This soil has good potential for specialty crops commonly grown in the county.

The main limitation is slope. The main problems of management are controlling soil blowing and water erosion, conserving moisture, and maintaining fertility and content of organic matter. If this soil is used for cultivated or specialty crops, it should be fertilized and irrigated. Conservation tillage, mulch, and cover crops help to control excessive soil blowing and water erosion. Returning crop residue to the soil or regular addition of other organic material helps to improve fertility and the available water capacity.

Specialty crops need additional water during the growing season. Irrigation and fertilization of the soils increases the production of peaches, cherries, strawberries, and tomatoes. Good air drainage helps to protect fruit from frost damage late in the growing season. Fruit crops need special and intensive management, such as controlling erosion and maintaining soil moisture with cover crops and mulch. Other crops that are grown on this soil are apples, grapes, and asparagus.

Pasture or hay crops are effective in controlling soil blowing. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during dry periods help to keep the pasture and soil in good condition.

This soil is well suited to trees. A few small areas are in native hardwoods.

This soil is suited to building site developments. The poor filtering capacity is a severe limitation for septic tank absorption fields. Slope is a limitation for building site developments. Slope and seepage are limitations for sewage lagoons. Slopes should be reshaped by cutting and filling. Retaining walls help to control caving cutbanks. The bottom and sides of lagoons should be covered with impervious material.

This soil is in capability subclass IIIe and Michigan soil management group 3a.

11D—Oshtemo sandy loam, 12 to 18 percent slopes. This strongly sloping, well drained soil is on elongated and irregularly shaped convex areas. Individual areas range from 3 to 50 acres.

Typically, the surface layer is dark grayish brown sandy loam about 5 inches thick. The subsoil is about 35 inches thick. The upper part is dark brown and dark reddish brown, friable sandy loam; the middle part is dark brown, very friable loamy sand; and the lower part is yellowish brown, loose sand with thin strata of loamy sand. In places, the subsoil has bands of loamy fine sand and fine sand. Some areas have a sand or loamy sand surface layer more than 20 inches thick.

Included with this soil in mapping are small areas of somewhat poorly drained Brady and Thetford soils. They are in natural waterways and depressions. Each makes up 5 to 10 percent of the unit. These inclusions do not exceed 15 percent of any one delineated map unit.

Permeability of this Oshtemo soil is moderately rapid in the upper part of the subsoil and very rapid in the lower part. Surface runoff is medium. The available water capacity is moderate. The surface layer is very friable and easily tilled.

Some areas of this soil are farmed, but they need high intensity management. Other areas are used as woodland or left idle. This soil has fair potential for cultivated crops and specialty crops commonly grown in the county. It has good potential for pasture and hay. It has fair to poor potential for recreation uses, septic tank absorption fields, and building site developments because of slope. It has good potential for use as woodland.

The main problems of management are slope, controlling soil blowing and erosion, conserving moisture, and maintaining fertility and organic matter content. If this soil is used for cultivated or specialty crops, it should be fertilized and irrigated. Windstrips and contour stripcropping are helpful conservation practices. Conservation tillage, mulch and cover crops help to prevent excessive soil loss caused by soil blowing and water erosion. Returning crop residue to the soil or the regular addition of other organic matter helps to improve fertility and the available water capacity.

Specialty crops grown on this soil are apples, peaches, and grapes. Irrigation and fertilization increase the production of peaches. Equipment use is limited on the steeper slopes. Fruit crops need special and intensive management, such as controlling erosion by using cover crops and maintaining soil moisture.

Pasture or hay crops are effective in controlling soil blowing. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during dry periods help to keep the pasture and soil in good condition.

This soil is well suited to the production of trees. A few areas are in native hardwoods.

This soil is poorly suited to building site developments, septic tank absorption fields, and sewage lagoons. Slope is a limitation for septic tank absorption fields, building site developments, and local roads and streets. Land forming or placing local roads and streets on the contour helps to offset this limitation.

This soil is in capability subclass IVe and Michigan soil management group 3a.

11E—Oshtemo sandy loam, 18 to 35 percent slopes. This moderately steep and steep, well drained soil is on elongated and irregularly shaped convex areas. Individual areas range from 3 to 30 acres.

Typically, the surface layer is brown sandy loam about 4 inches thick. The subsoil is about 34 inches thick. The upper part is dark brown and dark reddish brown, friable sandy loam; the middle part is dark brown, very friable loamy sand; and the lower part is yellowish brown, loose sand with thin strata of loamy sand. In places, the subsoil has bands of loamy fine sand and fine sand. Some areas have a sand or loamy sand surface layer more than 20 inches thick.

Included with this soil in mapping are small areas of somewhat poorly drained Brady soils on the foot slopes. They make up 3 to 5 percent of the unit.

Permeability of this Oshtemo soil is moderately rapid in the upper part of the subsoil and very rapid in the lower part. Surface runoff is rapid. The available water capacity is moderate. The surface layer is very friable.

Most areas of this soil are in pasture, used as woodland, or left idle. This soil has poor potential for cultivated crops, specialty crops, recreation uses, septic tank absorption fields, and building site developments. It has fair potential for pasture, hay, and wildlife habitat. It has good potential for woodland.

Pasture crops are effective in controlling soil blowing and water erosion. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during dry periods help to keep the pasture and soil in good condition.

This soil is suited to trees. Some areas are in native hardwoods. The hazard of erosion is moderate. Erosion control measures, such as using ditches, culverts, and waterbreaks and crowning the road surface, are often needed. Slope is a limitation for the use of heavy equipment for planting, tending, and harvesting trees. Careful operation of equipment is necessary for safety.

This soil is poorly suited to building site developments, septic tank absorption fields, and sewage lagoons. These uses are not practical on this soil because slope is a severe limitation.

This soil is in capability subclass VIe and Michigan soil management group 4a.

12A—Ockley loam, 0 to 2 percent slopes. This nearly level, well drained soil is in broad, flat areas. Individual areas are irregularly shaped and range from 3 to 400 acres.

Typically, the surface layer is dark grayish brown loam about 9 inches thick. The dominantly dark brown subsoil is about 43 inches thick. The upper part is gravelly clay loam; the middle part is gravelly sandy clay loam and sandy loam; and the lower part is loamy sand. The underlying material is dark yellowish brown gravelly coarse sand to a depth of about 60 inches.

Included with this soil in mapping are small areas of somewhat poorly drained Monitor soils. These soils are in shallow depressions and drainageways and make up 2 to 7 percent of the unit.

Permeability of this Ockley soil is moderate, and surface runoff is slow. The available water capacity is moderate. The surface layer is friable and easily tilled throughout a fairly wide range in moisture content. It has a tendency to crust or become puddled after hard rains.

Most areas of this soil are farmed. The soil has good potential for cultivated crops, specialty crops, hay, pasture, woodland, and septic tank absorption fields. It has fair to good potential for building site developments.

This soil is used for corn, soybeans, small grain, legumes for hay and pasture, orchards, and other specialty crops. The main problems of management are preventing soil blowing and maintaining organic matter content. Pasture or hay is effective in controlling soil blowing. Using winter cover crops or returning crop residue to the soil is also effective in reducing soil blowing.

Specialty crops need some additional sources of water during the growing season. Irrigation and fertilization increase production of peaches, cherries, tomatoes, and strawberries. Good air drainage is needed to help protect fruit from frost damage late in the growing season. Other specialty crops are apples, grapes, and asparagus.

Trees are well suited to this soil. A few small areas are in native hardwoods.

This soil is suited to building site developments and septic tank absorption fields. The shrink-swell potential is a limitation for building site developments. This limitation can be offset by replacing the upper layers of the soil with suitable base material.

This soil is in capability class I and Michigan soil management group 2.5a.

12B—Ockley loam, 2 to 6 percent slopes. This gently sloping, well drained soil is on slightly convex plains or ridgetops. Individual areas are irregular in shape and range from 5 to 240 acres.

Typically, the surface layer is dark grayish brown loam about 6 inches thick. The dominantly dark brown subsoil is about 43 inches thick. The upper part is gravelly clay

loam, the middle part is gravelly sandy clay loam and sandy loam, and the lower part is loamy sand. The underlying material is dark yellowish brown gravelly coarse sand to a depth of about 60 inches.

Included with this soil in mapping are small areas of the somewhat poorly drained Monitor soils. The soils are in shallow depressions and drainageways and make up 2 to 7 percent of the unit.

Permeability of this Ockley soil is moderate, and surface runoff is slow. The available water capacity is moderate. The surface layer is friable and easily tilled throughout a fairly wide range in moisture content. This soil has a tendency to crust or become puddled after hard rains, especially in areas where the plow layer contains subsoil material.

Most areas of this soil are farmed. The soil has good potential for cultivated crops, specialty crops, hay, pasture, woodland, and septic tank absorption fields. It has fair to good potential for most building site developments.

This soil is used for corn, soybeans, small grain, legumes for hay and pasture, orchards, and other specialty crops. The main problems of management are preventing erosion and maintaining organic matter content. Pasture or hay crops are effective in controlling erosion. Growing winter cover crops and returning crop residue to the soil are also effective in reducing erosion and crusting.

Specialty crops need some additional water during the growing season. Irrigation and fertilization increase production of peaches, cherries, tomatoes, and strawberries. Good air drainage is needed to help protect fruit from frost damage late in the growing season. Fruit crops need special and intensive management, such as controlling erosion. Other specialty crops, such as apples, grapes, and asparagus, are grown on this soil.

Trees are well suited to this soil. A few small areas are in native hardwoods.

This soil is suited to building site developments and septic tank absorption fields. The shrink-swell potential is a limitation for building site developments. This limitation can be controlled by replacing the upper layers of the soil with suitable base material.

This soil is in capability subclass IIe and Michigan soil management group 2.5a.

12C—Ockley loam, 6 to 12 percent slopes. This well drained, sloping soil is on convex knolls and short uneven side slopes. Individual areas are irregular in shape and range from 3 to 50 acres.

Typically, the surface layer is dark grayish brown loam about 9 inches thick. The dominantly dark brown subsoil is about 39 inches thick. The upper part is gravelly clay loam; the middle part is gravelly sandy clay loam and sandy loam, and the lower part is loamy sand. The underlying material is dark yellowish brown gravelly coarse sand to a depth of about 60 inches.

Included with this soil in mapping are small areas of the somewhat poorly drained Monitor soils. These soils are in shallow depressions and drainageways and make up to 2 to 5 percent of the unit.

Permeability of this Ockley soil is moderate, and surface runoff is medium. The available water capacity is moderate. The surface layer is friable and easily tilled throughout a fairly wide range in moisture content. The soil has a tendency to crust or become puddled after hard rains, especially in areas where the plow layer contains subsoil material.

Most areas of this soil are farmed. The soil has fair potential for cultivated crops. It has good potential for hay, pasture, and specialty crops. It has fair to good potential for septic tank absorption fields and most building site developments.

This soil is used for corn, soybeans, small grain, legumes for hay and pasture, and such specialty crops as peaches and cherries. The main limitation is slope. The main problems of management are preventing erosion and maintaining organic matter content. Pasture or hay is effective in controlling erosion. Using winter cover crops or leaving crop residue on the surface is also effective. Windstrips and contour stripcropping are also beneficial conservation practices.

Specialty crops need some additional water during the growing season. Production of peaches, cherries, strawberries, and tomatoes is increased with irrigation and fertilization of this soil. Fruit crops need special and intensive management, such as controlling erosion by using cover crops and mulch. Other specialty crops are apples, grapes, and asparagus.

Trees are well suited to this soil. A few small areas are in native hardwoods.

This soil is suited to building site developments and septic tank absorption fields. It has a moderate shrink-swell potential, which can affect dwellings. This limitation can be offset by replacing or covering the upper layers of the soil with suitable base material. Slope is a limitation for building site developments and septic tank absorption fields. Slopes should be reshaped by cutting and filling. Retaining walls should be used for dwellings to help offset this limitation. Absorption field tile should be installed on the contour.

This soil is in capability subclass IIIe and Michigan soil management group 2.5a.

12D—Ockley loam, 12 to 18 percent slopes. This strongly sloping, well drained soil is on convex areas. Individual areas are irregular or elongated in shape and range from 4 to 50 acres.

Typically, the surface layer is dark grayish brown loam about 4 inches thick. The dominantly dark brown subsoil is about 40 inches thick. The upper part is gravelly clay loam; the middle part is gravelly sandy clay loam and sandy loam; and the lower part is loamy sand. The underlying material is dark yellowish brown gravelly coarse sand to a depth of about 60 inches.

Included with this soil in mapping are small areas of the somewhat poorly drained Monitor soils. These soils

are in shallow depressions and drainageways and make up 2 to 5 percent of the unit.

Permeability of this Ockley soil is moderate, and surface runoff is rapid. The available water capacity is moderate. The surface layer is friable and easily tilled throughout a fairly wide range in moisture content. The soil has a tendency to crust or become puddled after hard rains, especially in areas where the plow layer contains subsoil material.

Most areas of this soil are left idle or used as woodland. Some areas are farmed. The soil has fair potential for cultivated crops. It has good potential for fruit crops, hay, and pasture. It has fair to poor potential for septic tank absorption fields and most building site developments.

This soil is used for small grain, legumes for hay and pasture, and such specialty crops as peaches. The main problems of management are slope, controlling soil erosion, and maintaining organic matter content. The use of this soil for pasture or hay is effective in controlling erosion. Using winter cover crops or leaving crop residue on the soil is also effective. Conservation tillage is effective in controlling erosion on the steeper areas. These practices increase the suitability of this soil for such row crops as corn and soybeans.

Specialty crops need some additional water during the growing season. Peach production increases if this soil is fertilized and irrigated. Fruit crops need special and intensive management, such as controlling erosion by using cover crops. Equipment use is limited on the steeper slopes. Other specialty crops are apples and grapes.

Trees are well suited to this soil. A few small areas are in native hardwoods.

This soil is poorly suited to building site developments and septic tank absorption fields. Slope is a limitation for septic tank absorption fields, building site developments, and local roads and streets. Land forming or placing local roads and streets on the contour helps to offset this limitation.

This soil is in capability subclass IVe and Michigan soil management group 2.5a.

13B—Spinks loamy fine sand, 0 to 6 percent slopes. This nearly level and gently sloping, well drained soil is on flat or slightly convex plains. Individual areas are irregular in shape and range from 3 to 660 acres (fig. 11).

Typically, the surface layer is dark brown loamy fine sand about 10 inches thick. The subsurface layer is light yellowish brown fine sand about 6 inches thick. Below that is brownish yellow or light brown, loose, fine sand with thin strata of dark brown, very friable sand or loamy fine sand to a depth of about 60 inches. Some areas have a continuous sandy loam subsoil immediately below the surface layer, and other areas do not have the banded subsoil.

Figure 11.—Profile of Spinks loamy fine sand, 0 to 6 percent slopes, showing texture bands in fine sandy material (scale in feet).

Included with this soil in mapping are small areas of the somewhat poorly drained Thetford and Brady soils. These soils are in shallow depressions and drainageways. Each makes up 5 to 12 percent of the unit. Small areas of soils near the uplands that have silty clay loam underlying material at a depth of 40 to 60 inches make up 2 to 7 percent of the unit. These inclusions do not exceed 15 percent of any one delineated map unit.

Permeability of this Spinks soil is moderately rapid or rapid, and surface runoff is slow. The available water capacity is low. The surface layer is very friable and easily tilled throughout a wide range in moisture content.

Most areas of this soil are used for cultivated crops, but some areas are left idle or used for nonfarm purposes. This soil has fair potential for cultivated crops. It has good potential for hay, pasture, and many specialty crops commonly grown in the county. It has good potential for most building site developments and fair potential for septic tank absorption fields.

The main problems of management are controlling soil blowing, conserving moisture, and maintaining organic matter content and fertility. Cover crops, conservation tillage, and irrigation help to control excessive soil loss caused by soil blowing and also help to maintain organic matter content.

Specialty crops need additional water during the growing season. Irrigation and fertilization increase production of peaches, cherries, strawberries, and tomatoes. Good air drainage helps to protect fruit from frost damage late in the growing season. Fruit crops need special and intensive management, such as controlling soil blowing by using cover crops and mulch and maintaining soil moisture. Other specialty crops grown on this soil are apples, grapes, and asparagus.

Pasture or hay crops are effective in controlling erosion. Additional water is needed on this soil for optimum use. Proper stocking, pasture rotation, timely deferment of grazing, restricted use during dry periods, and maintenance of proper fertility levels help to keep the pasture in good condition.

This soil is well suited to trees. A few small areas are in native hardwoods.

This soil is suited to building site developments. It is poorly suited to septic tank absorption fields because of the poor filtering capacity, and it is poorly suited to sewage lagoons because of seepage. Caving cutbanks is a limitation for shallow excavations. Trench walls should be reinforced to offset this limitation.

This soil is in capability subclass IIIs and Michigan soil management group 4a.

13C—Spinks loamy fine sand, 6 to 12 percent slopes. This sloping, well drained soil is on convex areas. Individual areas are irregular in shape and range from 3 to 35 acres.

Typically, the surface layer is dark brown loamy fine sand about 9 inches thick. Below that to a depth of about 60 inches, is brownish yellow or light brown, loose fine sand with thin strata of brown, friable loamy sand. Some areas have a continuous sandy loam subsoil immediately below the surface layer. Some areas do not have the banded subsoil.

Included with this soil in mapping are small areas of somewhat poorly drained Thetford and Morocco soils. These soils are in waterways and depressions. Each makes up 2 to 7 percent of the unit. Small areas of less droughty Tustin soils and soils that have silty clay loam underlying material at a depth of 40 to 60 inches make up 2 to 7 percent of the unit. These soils are on areas adjoining the uplands. These inclusions do not exceed 15 percent of any one delineated map unit.

Permeability of this Spinks soil is moderately rapid or rapid, and surface runoff is slow. The available water capacity is low. The surface layer is very friable and easily tilled throughout a wide range in moisture content.

Most areas of this soil are used as cropland, but some areas are left idle or are used for nonfarm purposes. This soil has fair potential for cultivated crops. It has good potential for hay, pasture, and many specialty crops, such as peaches, grapes, and cherries. It also has good potential for most building site developments and fair potential for septic tank absorption fields.

The main problems of management are slope, controlling soil blowing, conserving moisture in midsummer, and maintaining organic matter and fertility. Conservation tillage, winter cover crops, irrigation, and planting windbreaks help to control soil blowing, conserve moisture in midsummer, and maintain organic matter content. Other ways to control soil blowing are seeding to grass or sodding and fertilizing.

Specialty crops need additional water during the growing season. Irrigation and fertilization increase production of peaches, cherries, strawberries, and tomatoes. Fruit crops need special and intensive management, such as controlling soil blowing and erosion by using cover crops and mulch. Maintaining soil moisture is important. Other specialty crops are apples, grapes, and asparagus.

Pasture or hay crops are effective in controlling erosion. Supplemental water by irrigation is needed on these soils for optimum use. Proper stocking, pasture rotation, timely deferment of grazing, restricted use during dry periods, and maintenance of proper fertility levels help to keep the pasture in good condition.

This soil is well suited to trees. A few small areas are in native hardwoods.

This soil is suited to building site developments. It is poorly suited to septic tank absorption fields and sewage lagoons. Caving cutbanks is a limitation for shallow excavations. Slope is a limitation for installation and operation of septic tank absorption fields and sewage lagoons. Absorption fields need to be placed on the contour. Slopes should be reshaped by cutting and filling. Retaining walls should be used to help control the slope limitation for building site developments.

This soil is in capability subclass IIIe and Michigan soil management group 4a.

13D—Spinks loamy fine sand, 12 to 18 percent slopes. This strongly sloping, well drained soil is on convex areas. Individual areas are irregular or elongated in shape and range from 3 to 50 acres.

Typically, the surface layer is dark brown loamy fine sand about 10 inches thick. The subsurface layer is light yellowish brown fine sand about 5 inches thick. Below that is brownish yellow or light brown, loose fine sand with thin strata of very friable sand or loamy fine sand to a depth of about 60 inches. Some areas have a thin surface layer 3 to 7 inches thick. On the crest of some hills and knolls are small areas that do not have a banded subsoil and small areas that have a continuous sandy loam subsoil immediately below the surface layer.

Included with this soil in mapping are small areas of the somewhat poorly drained Thetford and Morocco soils. These soils are in waterways and depressions. Each makes up 2 to 5 percent of the unit. Small areas of less droughty Tustin soils and soils that have silty clay loam underlying material at a depth of 40 to 60 inches make up 2 to 5 percent of the unit.

Permeability of this Spinks soil is moderately rapid or rapid, and surface runoff is medium. The available water capacity is low. The surface layer is very friable and easily tilled throughout a wide range in moisture content.

Most areas of this soil are left idle or used for pasture. Some areas are used as woodland or as peach and cherry orchards. The soil has fair potential for cultivated crops. It has good potential for hay, pasture, and trees. If irrigated, this soil has good potential for some specialty crops, such as peaches, grapes, and cherries. It has fair to poor potential for many building site developments and septic tank absorption fields.

The main problems of management are slope, controlling soil blowing, conserving moisture in midsummer, and maintaining organic matter content and fertility. Conservation tillage, winter cover crops, irrigation, and planting windbreaks help to control soil blowing, conserve moisture in midsummer, and maintain organic matter content. Other ways to control soil blowing are seeding to grass or sodding and fertilizing.

Specialty crops need additional water during the growing season. Irrigation and fertilization increase production of peaches. Equipment use is limited on the steep slopes. Soils used for fruit crops need special and intensive management, such as controlling erosion and maintaining soil moisture by using cover crops and mulch. Other specialty crops grown on this soil are apples, cherries, and grapes.

Pasture or hay crops are effective in controlling soil blowing. Proper stocking, pasture rotation, timely deferment of grazing, restricted use during dry periods, and maintenance of proper fertility levels help to keep the pasture in good condition.

This soil is well suited to trees. A few areas are in native hardwoods.

This soil is poorly suited to building site developments, septic tank absorption fields, and sewage lagoons. Slope is a limitation for septic tank absorption fields, building site developments, and local roads and streets. Land forming or placing local roads and streets on the contour helps to offset this limitation. Placing septic tank absorption field tile on the contour helps to offset this limitation. Trench walls should be reinforced to prevent caving cutbanks of shallow excavations.

This soil is in capability subclass IVe and Michigan soil management group 4a.

14B—Riddles loam, 2 to 6 percent slopes. This gently sloping, well drained soil is on convex ridgetops, knolls, and short, uneven side slopes. Individual areas are irregular in shape and range from 3 to 240 acres.

Typically, the surface layer is dark brown loam about 7 inches thick. The dominantly yellowish brown, friable or firm sandy clay loam subsoil is about 48 inches thick. The underlying material is dark yellowish brown, mottled loam to a depth of about 63 inches. Some areas have a finer textured subsoil.

Included with this soil in mapping are small areas of somewhat poorly drained Crosier and Blount soils. These soils are in shallow depressions and drainageways. Each makes up 2 to 12 percent of the unit. These inclusions do not exceed 15 percent of any one delineated map unit.

Permeability of this Riddles soil is moderate, and surface runoff is medium. The available water capacity is high. The surface layer is friable and easily tilled throughout a fairly wide range in moisture content. This soil has a tendency to crust or become puddled after heavy rains, especially in areas where the plow layer contains subsoil material.

Most areas of this soil are used as cropland. The soil has good potential for cultivated crops, many specialty crops, hay, pasture, and trees. It has fair to good potential for most building site developments and septic tank absorption fields.

The main problems of management are controlling soil erosion and maintaining fertility, organic matter content, and tilth. Conservation tillage, winter cover crops, and grassed waterways help to control erosion and maintain organic matter content. Returning crop residue to the soil or the regular addition of other organic material helps to improve soil fertility, reduce crusting, and increase water infiltration.

Areas used for specialty crops, such as strawberries, cherries, peaches, and tomatoes, can be irrigated to increase production. Good air drainage is needed to help protect fruit crops from frost damage late in the growing season. Fruit crops need special and intensive management, such as controlling erosion by using cover crops and mulch. Other specialty crops are apples and grapes.

Pasture or hay crops are effective in controlling erosion. Overgrazing or grazing when the soil is too wet

causes surface compaction, excessive runoff, and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is well suited to trees.

This soil is suited to building site developments and septic tank absorption fields. Frost action and low strength are limitations for local roads and streets. These limitations can be offset by replacing or covering the upper layers of the soil with suitable base material. Shrink-swell potential is a limitation for dwellings. This limitation can be offset by replacing the upper layers of the soil with suitable base material.

This soil is in capability subclass IIe and Michigan soil management group 2.5a.

14C—Riddles loam, 6 to 12 percent slopes. This sloping, well drained soil is on uneven side slopes of convex ridges and knolls. Individual areas are irregular in shape and range from 3 to 45 acres.

Typically, the surface layer is dark brown loam about 6 inches thick. The subsoil is about 38 inches thick. The upper part is light yellowish brown, friable sandy clay loam; the middle part is yellowish brown, firm clay loam; and the lower part is yellowish brown, friable sandy clay loam. The underlying material is yellowish brown loam to a depth of about 63 inches. Some areas have a finer textured subsoil.

Included with this soil in mapping are small areas of somewhat poorly drained Crosier and Blount soils. These soils are in drainageways and small shallow depressions. Each makes up 2 to 10 percent of the unit. These inclusions do not exceed 15 percent of any one delineated map unit.

Permeability of this Riddles soil is moderate, and surface runoff is medium. The available water capacity is high. The surface layer is friable and easily tilled throughout a fairly wide range in moisture content. This soil has a tendency to crust or become puddled after heavy rains, especially in areas where the plow layer contains subsoil material.

Most areas of this soil are used as cropland. The soil has fair potential for cultivated crops. It has good potential for many specialty crops, hay, trees, and pasture. This soil also has fair to poor potential for septic tank absorption fields and most building site developments.

The main problems affecting the use of this soil are erosion, slope, and moderate permeability. Conservation tillage, winter cover crops, grassed waterways, applying mulch, and building diversions and erosion control structures help to reduce soil loss by erosion to an acceptable rate. Returning crop residue to the soil or the regular addition of organic material helps to maintain organic matter content, reduce crusting, improve fertility, and increase water infiltration.

Areas used for specialty crops, such as strawberries, cherries, peaches, and tomatoes, can be irrigated to increase production. Good air drainage is needed to help protect fruit crops from frost damage late in the growing season. Fruit crops need special and intensive management, such as controlling erosion by using cover crops and mulch. Other specialty crops that are grown on this soil are apples and grapes.

Pasture or hay crops are effective in controlling erosion. Overgrazing or grazing when the soil is too wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is well suited to trees. A few areas are in native hardwoods.

This soil is suited to building site developments and septic tank absorption fields. Slope and the shrink-swell potential are limitations for dwellings. Low strength, frost action, and slope are limitations for local roads and streets. Slope is also a limitation for septic tank absorption fields. The upper layers of the soil need to be replaced with suitable base material to offset low strength, shrink-swell potential, and frost action. Slopes should be reshaped by cutting and filling. Retaining walls can be used to offset the slope limitation for dwellings. Absorption field tile should be installed on the contour.

This soil is in capability subclass IIIe and Michigan soil management group 2.5a.

14D—Riddles loam, 12 to 18 percent slopes. This strongly sloping, well drained soil is on uneven side slopes of convex ridges and knolls. Individual areas are irregular in shape and range from 3 to 25 acres.

Typically, the surface layer is dark brown loam about 7 inches thick. The subsoil is about 36 inches thick. The upper part is light yellowish brown, friable clay loam; the middle part is yellowish brown, firm clay loam; and the lower part is yellowish brown, friable sandy clay loam. The underlying material is yellowish brown loam to a depth of about 63 inches. Some areas have a finer textured subsoil.

Included with this soil in mapping are small areas of somewhat poorly drained Crosier and Blount soils. These soils are in drainageways and small shallow depressions. Each makes up 2 to 7 percent of the unit.

Permeability of this Riddles soil is moderate, and surface runoff is rapid. The available water capacity is high. The surface layer is friable and easily tilled throughout a fairly wide range in moisture content. This soil has a tendency to crust or become puddled after heavy rains, especially in areas where the plow layer contains subsoil material.

Most areas of this soil are left idle or used as woodland or cropland. The soil has fair potential for cultivated crops. It has good potential for woodland; for many specialty crops, such as apples, peaches, or cherries; and for hay and pasture. This soil has poor potential for most building site developments and septic tank absorption fields.

The main problems affecting the use of this soil are erosion, moderate permeability, and slope. Conservation tillage, winter cover crops, grassed waterways, applying mulch, and building diversions and erosion control structures help to prevent excessive soil erosion. Returning crop residue to the soil or the regular addition of organic material also helps to maintain organic matter content, reduce crusting, improve fertility, and increase water infiltration.

Areas used for specialty crops, such as peaches, can be irrigated to increase production. Other specialty crops grown on this soil are apples and grapes. Areas used for fruit crops need special and intensive management, such as controlling erosion by using cover crops and mulch. Equipment use is limited on the steeper slopes.

Pasture or hay crops are effective in controlling erosion. Overgrazing or grazing when the soil is too wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is well suited to trees. A few small areas are in native hardwoods.

This soil is poorly suited to building site developments and septic tank absorption fields. Slope is a severe limitation. Shrink-swell potential is a moderate limitation for dwellings, and frost action and low strength are moderate limitations for local roads and streets. Slope should be considered in building designs. Local roads and streets should be constructed as closely to the contour as possible. Absorption field tile should be installed on the contour. Shrink-swell potential, low strength, and frost action are limitations that can be offset by replacing the upper layers of the soil with suitable base material.

This soil is in capability subclass IVe and Michigan soil management group 2.5a.

14E—Riddles loam, 18 to 45 percent slopes. This moderately steep and very steep, well drained soil is on long to short, uneven side slopes along convex ridges and deeply incised drainageways. Individual areas are generally elongated and irregular in shape. They range from 10 to 60 acres.

Typically, the surface layer is dark brown loam about 4 inches thick. The subsoil is about 36 inches thick. The upper part is light yellowish brown, friable clay loam; the middle part is yellowish brown, firm sandy clay loam; and the lower part is yellowish brown, friable sandy clay loam. The underlying material is yellowish brown loam to a depth of about 63 inches. In some areas the surface layer is absent because of erosion.

Included with this soil in mapping are small areas of the droughtier Oshtemo soils, making up 4 to 10 percent of the unit and intermixed throughout.

Permeability of this Riddles soil is moderate, and surface runoff is rapid. The available water capacity is high. The surface layer has a tendency to crust or puddle after heavy rains.

Most areas of this soil are left idle, used for pasture, or used as woodland. Some areas are used for orchards. The soil has poor potential for cultivated crops, hay, and pasture. It has good potential for trees. It has poor potential for building site developments and septic tank absorption fields.

If properly managed, using this soil for pasture is effective in controlling erosion. Overgrazing or grazing when the soil is too wet, however, causes surface compaction, excessive runoff, and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition. This soil has severe limitations for hayland because of the steep slopes that restrict the use of haymaking machinery.

This soil is suited to trees. Some areas are in native hardwoods. The hazard of erosion is moderate. Erosion control measures, such as using ditches, culverts, outslope road surfaces, and waterbreaks, are often needed. Using heavy equipment for planting, tending, and harvesting trees is limited by the steep slopes. Careful operation of equipment is necessary for safety.

Building site developments and septic tank absorption fields are generally not practical on this soil. Slope is a limitation that is extremely difficult to overcome.

This soil is in capability subclass VIe and Michigan soil management group 2.5a.

15C—Glynwood loam, 6 to 12 percent slopes. This sloping, moderately well drained soil is on convex side slopes. Individual areas are elongated and irregular in shape and range from 5 to 80 acres.

Typically, the surface layer is dark grayish brown loam about 7 inches thick. The yellowish brown, mottled, firm subsoil is about 19 inches thick. The upper part is silty clay loam, and the lower part is clay. The underlying material is yellowish brown or light yellowish brown, mottled, calcareous silty clay loam to a depth of about 60 inches. In some places the subsoil does not have gray mottles, and in some places it is more permeable. Severe erosion is evident in some areas.

Included with this soil in mapping are small areas of the somewhat poorly drained Blount and Crosier soils. These soils are in small depressions, natural waterways, and at the base of slopes. Each makes up 5 to 10 percent of the unit.

Permeability of this Glynwood soil is slow, and surface runoff is rapid. The available water capacity is high. The surface layer is friable and easily tilled. This soil has a tendency to crust or puddle after heavy rains. The perched water table is at a depth of 2 to 3-1/2 feet during the wet season.

Most areas of this soil are used as cropland. The soil has fair potential for cultivated crops and specialty crops. It has good potential for pasture, hay, wildlife habitat, and woodland. It has fair or poor potential for most recreation uses, septic tank absorption fields, and building site developments.

The major problems of management are soil erosion, wetness, high clay content, and slope. If this soil is used for cultivated crops or specialty crops, there is a hazard of further erosion damage. Conservation tillage, winter cover crops, erosion control structures, and grassed waterways help to control excessive soil loss. Returning crop residue to the soil or the regular addition of other organic material helps to improve fertility, reduce crusting, and increase water infiltration.

Specialty crops, such as apples, grapes, pears, and plums, are grown on this soil. Air drainage is generally good. It helps to protect the fruit from frost damage late in the growing season. Soils used for fruit crops need special and intensive management, such as controlling erosion by using cover crops and mulch and removing excess water by using underground drains and shallow surface ditches.

Pasture or hay crops are effective in controlling erosion. Overgrazing or grazing when the soil is too wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is well suited to trees. Some areas are in native hardwoods. Some trees may be uprooted and blown down during storms. Expected loss of planted or natural seedlings is 25 to 50 percent. Harvest methods that do not leave trees standing alone or widely spaced should be selected. Special site preparation, such as furrowing before planting, should be used.

The seasonal high water table and slope are limitations for building site developments and septic tank absorption fields. Suitable fill material should be used to raise building site levels. Subsurface drainage should be installed to lower the water table. Reshaping slopes by cutting and filling and using retaining walls help to offset the slope limitation for dwellings. Conventional septic tank absorption fields generally are not practical on this soil. Frost action, slope, and low strength are limitations for local roads and streets. The frost action and low strength can be offset by replacing the upper layers of the soil with suitable base material.

This soil is in capability subclass IIIe and Michigan soil management group 1.5a.

16B—Crosier silt loam, 0 to 4 percent slopes. This nearly level and gently sloping, somewhat poorly drained soil is on convex slopes and in concave areas along drainageways. Individual areas are irregular in shape and range from 3 to 60 acres.

Typically, the surface layer is brown silt loam about 9 inches thick. The mottled subsoil is about 37 inches thick. The upper part is light brownish gray, friable silt loam; the middle part is yellowish brown, firm silty clay loam; and the lower part is brownish yellow, friable silt loam. The underlying material to a depth of about 60 inches is light yellowish brown, mottled silt loam. In some places the surface layer is darker. Also, in some areas the subsoil is finer textured, and the underlying material is sand or sand and gravelly sand.

Included with this soil in mapping are small areas of very poorly drained Rensselaer soils. These soils are in concave depressions and natural waterways and make up 3 to 8 percent of the unit.

Permeability of this Crosier soil is moderately slow, and surface runoff is slow or medium. The available water capacity is high. The surface layer is friable and easily tilled throughout a fairly wide range in moisture content. The water table is at a depth of 1 to 3 feet during the wet season.

Most areas of this soil are used as cropland. The soil has good potential for cultivated crops, specialty crops, woodland, pasture, hay, and wildlife habitat. It has fair or poor potential for most recreation uses, septic tank absorption fields, and building site developments.

The main concerns of management are removing excess water and maintaining soil tilth. If this soil is used for cultivated crops or specialty crops, installing underground drains to remove excess water is a beneficial conservation practice. During tiling operations, a blinding material should be used to help keep the tile free of sediment. Conservation tillage, winter cover crops, and grassed waterways help to control erosion and maintain soil tilth. Returning crop residue to the soil or the regular addition of other organic material helps to improve fertility, reduce crusting, and increase water infiltration.

Specialty crops, such as apples, grapes, pears, plums, and tomatoes are grown on this soil. Good air drainage is needed to help protect fruit crops from frost damage late in the growing season. Areas used for fruit crops need special and intensive management, such as controlling erosion by using cover crops and removing excess water by using underground drains and shallow surface ditches.

Pasture or hay crops are effective in controlling erosion. Overgrazing when the soil is too wet, however, causes surface compaction, excessive runoff, and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

The seasonal high water table is a limitation for septic tank absorption fields and building site developments. Conventional septic tank absorption fields are generally not practical on this soil. This soil can be made suitable for buildings with basements if the building site level is raised by using suitable filler material and if subsurface drainage is installed. Frost action and low strength are limitations for local roads and streets. These limitations can be offset by replacing the upper soil layers with suitable base material. Surface drains should be used to reduce wetness.

This soil is in capability subclass IIw and Michigan soil management group 2.5b.

17—Rensselaer silt loam. This nearly level, very poorly drained soil is in natural drainageways, in small to

large depressions, and on broad, flat plains. It is subject to ponding. Individual areas are irregular in shape and range from 3 to 50 acres.

Typically, the surface layer is very dark grayish brown silt loam about 10 inches thick. The mottled, friable subsoil is about 37 inches thick. The upper part is grayish brown loam; the middle part is gray silt loam; and the lower part is yellowish brown loam. The underlying material is yellowish brown and light yellowish brown, mottled, calcareous silt loam to a depth of about 60 inches. In some places the surface layer is sandy loam and less than 10 inches thick.

Included with this soil in mapping are small areas of somewhat poorly drained Crosier and Selfridge soils. They are on the slightly higher rises and knolls, and each makes up 2 to 10 percent of the unit. These inclusions do not exceed 15 percent of any one delineated map unit.

Permeability of this Rensselaer soil is slow, and surface runoff is slow to ponded. The available water capacity is high. The surface layer has a tendency to crust or become puddled after heavy rains. The water table ranges from 1/2 foot above to 1 foot below the surface during the winter and spring months.

Most areas of this soil are used as cropland. The soil has good potential for cultivated crops, hay, and pasture. It has poor potential for woodland, building site developments, septic tank absorption fields, and recreation uses.

The main problems of management are removing excess water and maintaining fertility and tilth. The use of farm equipment should be delayed after wet periods until the soil has dried sufficiently to prevent damage to the soil structure. If this soil is used for cultivated crops, such as corn, soybeans, small grain, and hay crops, underground drains are needed for best results. During tiling operations, blinding material is needed to prevent silty material from plugging up the tile lines. Conservation tillage, returning crop residue or regular addition of other organic material to the soil, and staying off the soil if it is wet help to reduce crusting, increase water infiltration, and maintain good soil tilth.

Specialty crops, such as tomatoes, are grown on this soil. Some areas are irrigated. Growth of other specialty crops is limited by the frost hazard and excess wetness during most of the year. Underground drains are needed to help lower the water table. Air drainage is poor because of the low elevation of this soil.

If this soil is used for pasture or hay, proper stocking, pasture rotation, and restricted use during wet periods are needed. These management practices and careful selection of grasses are needed to keep the pasture and soil in good condition.

This soil has severe limitations for planting or harvesting trees. Woodland operations should be conducted during seasons of the year when the soil is relatively dry or frozen. Expected losses of planted seedlings are more than 50 percent. Trees are blown down by storms when the soil is wet. Harvest methods that do not leave trees standing alone or widely spaced should be selected. Plans should be developed for periodic salvage of windthrown trees when needed.

Building site developments and septic tank absorption fields are not practical on this soil. They are generally not practical because the soil is ponded.

This soil is in capability subclass IIw and Michigan soil management group 2.5c.

19A—Brady sandy loam, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on flat plains. Individual areas are irregular in shape and range from 3 to 500 acres.

Typically, the surface layer is very dark grayish brown sandy loam about 11 inches thick. The mottled subsoil is about 37 inches thick. The upper part is pale brown, friable sandy loam; the middle part is strong brown, friable sandy loam; and the lower part is gray, stratified, friable loam and loamy sand. The underlying material is grayish brown or brown sand to a depth of about 60 inches. Some areas of this soil have a banded, fine sand and loamy fine sand subsoil. A finer textured subsoil is in some areas. In some areas, the underlying material is more acid. The surface layer is lighter colored in places.

Included with this soil in mapping are small areas of well drained Oshtemo soils. These soils are on the crests of small knolls and make up 2 to 6 percent of the unit. Small areas of very poorly drained Gilford soils are also included in mapping. These soils are in small depressions and drainageways and make up 2 to 9 percent of the unit.

Permeability of this Brady soil is moderately rapid in the subsoil and very rapid in the underlying material. Surface runoff is slow. The available water capacity is moderate. The surface layer is friable and easily tilled throughout a fairly wide range in moisture content. This soil has a seasonal high water table at a depth of 1 foot to 3 feet during spring and in fall.

Most areas of this soil are used as woodland. The soil has good potential for cultivated crops and woodland. It has good potential for hay, pasture, and some specialty crops, such as tomatoes and cucumbers. It has poor potential for most building site developments and septic tank absorption fields.

The main problems of management are removing excess water and controlling soil blowing during dry periods. Artificial drainage can be successfully used on this soil to lower the seasonal high water table. Earlier spring planting is then possible. During tiling operations, a blinding material should be used to help keep the tile free of sediment. Conservation tillage, windbreaks, winter cover crops, and irrigation during dry periods help to prevent soil blowing.

Specialty crops, such as blueberries and tomatoes, need irrigation. This soil has poor air drainage and a seasonal high water table that limit the variety of crops grown. Underground drains are needed to help lower the

water table. Other specialty crops are apples, grapes, and asparagus.

Pasture or hay crops are effective in controlling soil blowing. Proper stocking, pasture rotation, and timely deferment of grazing help to keep the pasture and soil in good condition.

The seasonal high water table is a limitation for septic tank absorption fields and building site developments. Conventional septic tank absorption fields generally are not practical on this soil. This soil can be made suitable for buildings without basements if the building site level is raised by using suitable fill material and if subsurface drainage is installed. Frost action is a limitation for local roads and streets. This limitation can be offset by replacing the upper soil layers with suitable base material. Also, surface drainage should be used to reduce wetness.

This soil is in capability subclass IIw and Michigan soil management group 3b.

20—Gilford sandy loam. This nearly level, very poorly drained soil is in broad, low, flat areas and in narrow drainageways. It is subject to frequent ponding. Individual areas are irregular in shape and range from 5 to 400 acres.

Typically, the surface layer is very dark gray sandy loam about 11 inches thick. The mottled subsoil is about 27 inches thick. The upper part is dark gray, friable fine sandy loam and sandy loam; and the lower part is grayish brown, very friable loamy sand. The underlying material is light brownish gray sand to a depth of about 60 inches. In places, the subsoil is sand. The dark surface layer is less than 10 inches thick in some areas. The underlying material is more acid in places.

Included with this soil in mapping are small areas of somewhat poorly drained Brady soils on slightly higher ridges or knolls. These soils make up 5 to 10 percent of the unit.

Permeability of this Gilford soil is moderately rapid in the subsoil and rapid in the underlying material. Surface runoff is very slow or ponded. The available water capacity is moderate. The surface is friable and easily tilled. The water table ranges from 1/2 foot above to 1 foot below the surface during the wet season.

Most areas of this soil are used as cropland. Specialty crops do well in areas that are drained and irrigated. Other areas are used as woodland or left idle. This soil has fair potential for cultivated crops, specialty crops, woodland, and wildlife habitat. It has good potential for pasture and hay. It has poor potential for recreation uses, building site developments, and septic tank absorption fields.

The main problems of management are wetness, controlling soil blowing, and, if the soil is drained, conserving moisture in midsummer. If this soil is used for cultivated crops or specialty crops, underground drains and drainage ditches are needed to remove excess water. In this soil, tile needs a protective covering to keep free of flowing sand and silt. Conservation tillage, winter cover crops, leaving crop residue on the surface of the soil, and stripcropping help to control soil blowing.

Specialty crops, such as blueberries and tomatoes, are grown. Some areas of this soil are irrigated. This soil has poor air drainage and a seasonal high water table that limit the kinds of crops grown. Underground drains and deep ditches are needed to help lower the water table. Grapes are grown on this soil in some areas, but the hazard of frost damage is high.

Pasture or hay crops are effective in controlling soil blowing. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is poorly suited to use as woodland. It has severe limitations for using equipment to plant, tend, and harvest trees. Seedling mortality and windthrow hazard are severe limitations. Woodland operations should be conducted during seasons of the year when the soil is relatively dry or frozen. Special site preparation, such as bedding, should be used in some areas. Harvest methods that do not leave trees standing alone or widely spaced should be selected. Plans should be developed for periodic salvage of windthrown trees when needed.

Building site developments and septic tank absorption fields are not practical on this soil. They are generally not practical because of ponding.

This soil is in capability subclass IIw and Michigan soil management group 4c.

22A—Monitor loam, 0 to 3 percent slopes. This nearly level, somewhat poorly drained soil is on flat, broad plains and in small depressions and drainageways. Individual areas are irregular in shape and range from 5 to 120 acres.

Typically, the surface layer is very dark grayish brown loam about 9 inches thick. The mottled, friable subsoil is about 46 inches thick. The upper part is grayish brown silt loam; the middle part is dark yellowish brown sandy clay loam and dark brown clay loam; and the lower part is dark yellowish brown sandy loam. The underlying material is grayish brown, mottled gravelly loamy sand to a depth of about 60 inches. The subsoil is sandy in places.

Included with this soil in mapping are small areas of very poorly drained Gilford soils and poorly drained Sebewa soils. These soils are in drainageways and small depressions, and each makes up 7 to 12 percent of the unit. Small areas of soils that have a silty clay loam underlying material, 40 to 60 inches from the surface, are also included. These small areas are in positions near the uplands and make up 2 to 6 percent of the unit. The inclusions do not exceed 15 percent of any one delineated map unit.

Permeability of this Monitor soil is moderately slow, and surface runoff is slow. The available water capacity

is high. The surface layer is friable and easily tilled throughout a fairly wide range in moisture content. The water table is 1 foot to 3 feet during the wet season.

Most areas of this soil are used as cropland. The soil has good potential for cultivated crops, woodland, hay, pasture, and some specialty crops, such as tomatoes and cucumbers. It has poor potential for most building site developments and septic tank absorption fields.

Removing excess water and maintaining soil tilth and fertility are the main problems of management. Artificial drainage is needed to lower the water table. During installation, tile should be covered with straw, grass clippings, fiberglass, or other suitable material to prevent the clogging of tile lines by sand and silt.

Specialty crops, such as tomatoes, need irrigation. This soil has poor air drainage and a seasonal high water table that limit the kinds of crops grown. Underground drains are needed to help lower the water table. Other specialty crops are apples, grapes, and asparagus.

If this soil is used for pasture, proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods are necessary. These practices help to keep the pasture and soil in good condition. Overgrazing or grazing when the soil is too wet causes surface compaction, excessive runoff, and poor tilth.

The seasonal high water table is a limitation for septic tank absorption fields and building site developments. Conventional septic tank absorption fields generally are not practical on this soil. This soil can be made suitable for buildings without basements if the building site level is raised by using suitable fill material and if subsurface drainage is installed. Frost action and low strength are limitations for local roads and streets. These limitations can be offset by replacing the upper soil layers with suitable base material. Surface drains should be used to reduce wetness.

This soil is in capability subclass IIw and Michigan soil management group 2.5b.

23—Sebewa loam. This nearly level, poorly drained soil is in broad, flat, low areas. It is subject to frequent ponding. Individual areas are irregular in shape and range from 4 to 80 acres.

Typically, the surface layer is very dark brown loam about 13 inches thick. The subsoil, about 16 inches thick, is gray, mottled, friable clay loam. The underlying material is yellowish brown or gray, mottled sand to a depth of about 60 inches. In places, there is a clay subsoil.

Included with this soil in mapping are small areas of somewhat poorly drained Monitor soils at a slightly higher elevation. These inclusions make up about 6 to 12 percent of the unit.

Permeability of this Sebewa soil is moderate in the subsoil and rapid in the underlying sand and gravel material. Surface runoff is very slow or ponded. The available water capacity is moderate. The surface layer is friable and easily tilled. The water table ranges from 1 foot above to 1 foot below the surface during the wet season.

In areas that are adequately drained, cultivated and specialty crops are grown. Other areas are used as woodland or left idle. The soil has good potential for cultivated crops, specialty crops, pasture, hay, woodland, and wildlife habitat. It has poor potential for recreation uses, building site developments, and septic tank absorption fields.

The main problems of management are removing excess water and controlling soil blowing during dry periods. If this soil is used for cultivated or specialty crops, underground drains are needed to remove excess water. The tile needs protective covering, such as straw, grass clippings, fiberglass, or other suitable material, to keep tile lines free of sediment. Conservation tillage, winter cover crops, stripcropping, and windbreaks help to control soil blowing. Returning crop residue to the soil helps to improve fertility.

Specialty crops, such as tomatoes, are grown. Some areas of this soil are irrigated. The soil has poor air drainage and a seasonal high water table that limits the variety of crops grown. Underground drains and deep ditches are needed to help lower the water table. Grapes are grown on this soil in some areas, but the hazard of frost damage is high.

Pasture or hay crops are effective in controlling soil blowing. Overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition. Proper species selection of forage crops and tile drainage can help reduce winterkill.

This soil is fairly suited to use as woodland. It has severe limitations for using equipment to plant, tend, and harvest trees. Seedling mortality and windthrow hazard are severe limitations. Woodland operations should be conducted during seasons of the year when the soil is relatively dry or frozen. Special site preparations, such as bedding, should be used in some areas. Harvest methods that do not leave trees standing alone or widely spaced should be selected. Plans should be developed for periodic salvage of windthrown trees when needed.

Building site developments and septic tank absorption fields are not practical on this soil. They are generally not practical because of ponding.

This soil is in capability subclass IIw and Michigan soil management group 3/5c.

25—Lenawee silty clay loam. This nearly level, poorly drained soil is in natural drainageways and small to large depressions. It is subject to frequent ponding. Individual areas are irregular in shape and range from 3 to 50 acres.

Typically, the surface layer is very dark brown silty clay loam about 8 inches thick. The gray, mottled, firm subsoil

is about 18 inches thick. The upper part is clay, and the lower part is silty clay. The underlying material is olive gray or grayish brown, mottled, stratified silty clay loam, silty clay, silt, and silt loam to a depth of about 60 inches. In some areas the subsoil is coarser textured.

Included with this soil in mapping are small areas of somewhat poorly drained Blount and Kibbie soils. These soils are on the higher knolls, and each makes up 2 to 10 percent of the unit. Also included are small areas of poorly drained Belleville soils that are subject to soil blowing. These soils are in areas where there are sand smears and make up 2 to 7 percent of the unit. The inclusions do not exceed 15 percent of any one delineated map unit.

Permeability of this Lenawee soil is moderately slow, and surface runoff is very slow or ponded. The available water capacity is high. The soil has a tendency to crust or puddle after hard rains, especially in areas where the plow layer contains subsoil material. The water table ranges from 1 foot above to 1 foot below the surface during winter and spring months.

Most areas of this soil are used as cropland. The soil has good potential for cultivated crops, hay, and pasture. It has poor potential for woodland, building site developments, septic tank absorption fields, and recreation uses.

The main problems in management are removing excess water and maintaining soil tilth. If this soil is used for cultivated crops, underground drains are needed for best results. During tiling operations, grass clippings, straw, fiberglass, or other suitable blinding material is needed to prevent silty material from plugging up the tile lines. Returning crop residue to the soil and staying off the soil when it is wet help to reduce crusting, increase water infiltration, and maintain good soil tilth.

In some areas of this soil, specialty crops, such as grapes, are grown. This soil has poor air drainage that increases frost damage. Underground drains and deep ditches are needed to help control the excess water problem.

If this soil is used for pasture or hay, proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet seasons are necessary. These practices and careful selection of grasses are needed to keep the pasture and soil in good condition.

This soil is fairly suited to trees. Equipment used for planting, harvesting, and tending trees is severely limited to the kind and time of use. Expected losses of planted seedlings are more than 50 percent. Trees can be uprooted and blown down by storms when the soil is wet. Woodland operations should be conducted during seasons when the soil is relatively dry or frozen. Special site preparations, such as bedding, should be used in some areas. Harvest methods that do not leave trees standing alone or widely spaced should be selected.

Building site developments and septic tank absorption fields are not practical on this soil. They are generally not practical because of ponding.

This soil is in capability subclass IIw and Michigan soil management group 1.5c.

26A—Pipestone sand, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on plains. Individual areas are irregular in shape and range from 5 to 200 acres (fig. 12).

Typically, the surface layer is very dark brown sand about 8 inches thick. The subsurface layer is grayish

Figure 12.—Profile of Pipestone sand, 0 to 2 percent slopes, showing good horizon development below the surface horizon and a high water table in sandy material (scale in feet).

brown sand about 3 inches thick. The mottled subsoil is about 20 inches thick. The upper part is dark reddish brown, very friable sand; the lower part is yellowish brown, loose sand. The underlying material is light brownish gray sand to a depth of about 60 inches. Some places have bands of loamy fine sand in the subsoil.

Included with this soil in mapping are small areas of poorly drained Granby soils in small depressions or in the natural waterways. These soils make up about 6 to 10 percent of the unit. Small areas of somewhat poorly drained, less droughty Rimer loamy sand are included near uplands. This soil makes up 2 to 9 percent of the unit. The inclusions do not exceed 15 percent of any one delineated map unit.

Permeability is rapid in this Pipestone soil, and surface runoff is slow or very slow. The available water capacity is low. The surface is very friable and easily tilled. The water table is at a depth of 1/2 foot to 1-1/2 feet during the wet season.

Some areas of this soil are used as cropland. Specialty crops, such as blueberries, do well. Other areas are used as woodland or left idle. The soil has fair potential for cultivated crops, specialty crops, wildlife habitat, and woodland. It has good potential for pasture and hayland. It has fair to poor potential for recreation uses, building site developments, and septic tank absorption fields.

The main problems of management are controlling soil blowing, removing excess water, conserving moisture in midsummer, and maintaining fertility. If this soil is used for cultivated or specialty crops, underground drains for removing excess water and supplemental irrigation during midsummer are beneficial. Tile needs protective covering to keep it free of flowing sand and silt. Conservation tillage, winter cover crops, and stripcropping help to control excessive soil loss by soil blowing. Returning crop residue to the soil or the regular addition of other organic matter helps to improve fertility and available water capacity.

Specialty crops need additional water during the growing season. Irrigation and fertilization of the soil increase the production of blueberries and tomatoes. Good air drainage is needed to help protect fruit from frost damage late in the growing season. Areas used for fruit crops need special and intensive management, such as controlling soil blowing by using cover crops and mulch. Underground drains and deep ditches are needed to help lower the seasonal high water table. Other specialty crops are apples, grapes, and asparagus.

Pasture or hay crops are effective in controlling soil blowing. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is fairly suited to use as woodland. Seedling mortality is a severe limitation. Expected loss of planted or natural tree seedlings by dry weather conditions can be in excess of 50 percent. Special site preparations, such as furrowing, should be used before planting.

The seasonal high water table is a limitation for septic tank absorption fields and building site developments. Conventional septic tank absorption fields generally are not practical on this soil. The soil can be made suitable for buildings without basements if the building site level is raised by using suitable fill material and if subsurface drainage is installed.

This soil is in capability subclass IVw and Michigan soil management group 5b.

27B—Tustin loamy fine sand, 2 to 6 percent slopes. This gently sloping, well drained soil is on convex ridgetops, knolls, and short, uneven side slopes. Individual areas are irregular in shape and range from 5 to 75 acres.

Typically, the surface layer is brown loamy fine sand about 9 inches thick. The subsurface layer, about 27 inches thick, is yellowish brown loamy fine sand in the upper part, and light yellowish brown fine sand in the lower part. The subsoil is yellowish brown, firm silty clay about 20 inches thick. The underlying material is yellowish brown, mottled silty clay loam to a depth of about 60 inches. In places, the underlying material is not as high in clay content.

Included with this soil in mapping are small areas of poorly drained Belleville soils and somewhat poorly drained Rimer soils. These soil are in shallow depressions and drainageways, and each makes up 2 to 10 percent of the unit. These inclusions do not exceed 15 percent of any one delineation.

Permeability of this Tustin soil is rapid in the sandy subsoil and slow in the underlying material. Surface runoff is slow. The available water capacity is moderate. The surface layer is very friable and easily tilled.

Most areas of this soil are used as cropland. The soil has fair potential for cultivated and specialty crops, hay, pasture, and woodland. It has fair or poor potential for most building site developments and septic tank absorption fields. This soil has good to fair potential for recreation uses.

The main problems of management are controlling soil blowing, conserving moisture during dry periods, and maintaining organic matter content and fertility. Using winter cover crops, applying mulch, planting windbreaks, irrigating during dry periods, and seeding to grass or sodding and fertilizing help to prevent excessive soil loss by soil blowing and help to conserve moisture. Returning crop residue to the soil or the regular addition of organic material help to conserve moisture and maintain organic matter.

Specialty crops need additional water during the growing season. Irrigation and fertilization of the soil increase production of peaches, cherries, strawberries, and tomatoes. Good air drainage helps to protect fruit from frost damage late in the growing season. Areas used for fruit crops need special and intensive management, such as controlling soil blowing and water erosion and using cover crops and mulch to maintain soil moisture.

Pasture or hay crops are effective in controlling soil blowing. Irrigation is needed for best results. Proper stocking, pasture rotation, timely deferment of grazing, restricted use during dry periods, and maintenance of proper fertility levels help to keep the pasture in good condition.

This soil is fairly suited to trees. Some areas are in native hardwoods. Expected loss of planted seedlings is 25 to 50 percent. Special site preparations, such as furrowing before planting, should be used.

This soil is poorly suited to building site developments and septic tank absorption fields. It is fairly suited to sewage lagoons. The shrink-swell potential is a limitation for dwellings, and frost action is a limitation for local roads and streets. The shrink-swell potential and frost action can be offset by replacing the soil layers with suitable base material. Slow permeability is a limitation for absorption fields. Slow permeability of the lower layers of this soil and the poor filtering capacity of upper layers are limitations for septic tank absorption fields. Conventional septic tank absorption fields are generally not practical on this soil. The sides of the lagoons should be covered with impervious material to offset seepage.

This soil is in capability subclass IIIe and Michigan soil management group 4/1a.

27C—Tustin loamy fine sand, 6 to 12 percent slopes. This moderately sloping, well drained soil is on convex knolls and short, uneven side slopes. Individual areas are irregular in shape and range from 5 to 40 acres.

Typically, the surface layer is dark brown loamy fine sand about 5 inches thick. The subsurface layer, about 27 inches thick, is yellowish brown, loamy fine sand in the upper part and light yellowish brown fine sand in the lower part. The subsoil is yellowish brown, firm silty clay loam about 20 inches thick. The underlying material is yellowish brown, mottled clay loam to a depth of about 60 inches. In places, the sandy subsoil is not present. Also in some places, the underlying material is loamy.

Small areas of poorly drained Belleville and somewhat poorly drained Rimer soils are included in mapping. These soils are in the shallow depressions and drainageways. Each makes up 2 to 10 percent of the unit. These inclusions do not exceed 15 percent of any one delineated map unit.

Permeability of this Tustin soil is rapid in the sandy subsoil and slow in the underlying material. Surface runoff is medium. The available water capacity is moderate. The surface layer is very friable and easily tilled.

Most areas of this soil are used as cropland. The soil has fair potential for specialty crops, hay, pasture, and woodland. It has fair potential for cultivated crops and recreation uses. It has fair or poor potential for building site developments and septic tank absorption fields.

The main concerns of management are controlling soil blowing, preventing water erosion, conserving moisture, and maintaining organic matter content and fertility. Planting winter cover crops, applying mulch, planting windbreaks, irrigating during dry periods, and seeding to grass or sodding and fertilizing help to control excessive soil loss by soil blowing and conserve moisture. Returning crop residue to the soil or the regular addition of organic material helps to conserve moisture and maintain organic matter content.

Specialty crops need additional water during the growing season. Irrigation and fertilization of the soil increase the production of peaches, cherries, strawberries, and tomatoes. Good air drainage helps to protect fruit from frost damage late in the growing season. Areas used for fruit crops need special and intensive management, such as controlling soil blowing and water erosion and using cover crops and mulch to maintain soil moisture.

Pasture or hay crops are effective in controlling soil blowing. Irrigation is needed for best results. Proper stocking, pasture rotation, timely deferment of grazing, restricted use during dry periods, and maintenance of proper fertility levels help to keep the pasture in good condition.

This soil is fairly suited to trees. Some areas are in native hardwoods. Expected loss of planted seedlings is 25 to 50 percent. Special site preparations, such as furrowing before planting, should be used.

This soil is poorly suited to building site developments and septic tank absorption fields. The shrink-swell potential and slope are limitations for dwellings. Frost action and slope are limitations for local roads and streets. Slope and slow permeability are limitations for septic tank absorption fields. The shrink-swell potential and frost action can be offset by replacing the soil layers with suitable base material. Slopes should be reshaped by cutting and filling, and retaining walls should be used. Conventional septic tank absorption fields are generally not practical on this soil. Absorption field tile should be installed on the contour because of the slope limitation.

This soil is in capability subclass IVe and Michigan soil management group 4/1a.

28B—Rimer loamy fine sand, 0 to 4 percent slopes. This nearly level and gently sloping, somewhat poorly drained soil is on slightly convex plains, knolls, and short, uneven side slopes. Individual areas are irregular in shape and range from 5 to 800 acres.

Typically, the surface layer is very dark grayish brown loamy fine sand about 9 inches thick. The subsurface layer, about 23 inches thick, is pale brown and yellowish brown, mottled loamy fine sand and fine sand. The subsoil is gray, firm clay about 9 inches thick. The underlying material is yellowish brown, mottled clay to a depth of about 60 inches. In places, the underlying material is coarser textured. In some areas the surface layer is sandy loam.

Small areas of somewhat poorly drained Blount and Morocco soils are included in mapping. Blount soils are

on short, steep knolls and ridges. Morocco soils are in areas where the sand is thicker and are along drainageways. Each makes up 2 to 13 percent of the unit. Also included are small areas of well drained Tustin soils. These soils are on the crest of knolls and ridges and make up 4 to 10 percent of the unit. Small areas of poorly drained Belleville soils are also included. These soils are in drainageways and shallow depressions and make up 2 to 12 percent of the unit. The inclusions do not exceed 15 percent of any one delineated map unit.

Permeability of this Rimer soil is rapid in the sandy subsoil and very slow in the clayey underlying material. The surface runoff is slow. The available water capacity is moderate. The surface layer is very friable and easily tilled. The perched water table is at a depth of 1 foot to 2-1/2 feet during the winter and spring months.

Most areas of this soil are used as cropland or left idle. The soil has good potential for cultivated crops, hay, pasture, and trees. It has fair to good potential for specialty crops and poor potential for most building site developments and septic tank absorption fields. This soil has fair potential for most recreation uses.

The main problems of management are removing excess water, controlling soil blowing, and maintaining fertility and organic matter content. Winter cover crops, seeding to grass or sodding and fertilizing, irrigating during dry periods, and applying mulch help to control excessive soil loss by soil blowing. Returning crop residue to the soil or the regular additon of organic material helps to conserve moisture and maintain organic matter content. Underground drains are needed to get best results if row crops and specialty crops are grown.

Specialty crops, such as blueberries and tomatoes, need irrigation. Other specialty crops are apples, grapes, asparagus, plums, and pears. Good air drainage is needed to help protect fruit crops from frost damage late in the growing season. Areas used for fruit crops need special and intensive management, such as controlling erosion and using cover crops and mulch. Excess water should be removed by using underground drains and shallow surface ditches.

If this soil is used for pasture or hay, proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet seasons are needed to help keep the pasture and soil in good condition. Using this soil for pasture or hay is effective in controlling soil blowing.

This soil is fairly suited to trees. Expected loss of planted seedlings is 25 to 50 percent. Special site preparations, such as furrowing before planting, should be used.

The seasonal high water table is a limitation for building site developments and septic tank absorption fields. Frost action is a limitation for local roads and streets. The soil can be made suitable for buildings without basements if the building site level is raised by using suitable fill material and if subsurface drainage is installed. Conventional septic tank absorption fields are generally not practical on this soil. Frost action can be offset by replacing the lower clayey layers with suitable base material.

This soil is in capability subclass IIw and Michigan soil management group 4/1b.

29—Cohoctah sandy loam. This nearly level, poorly drained soil is on narrow to broad elongated areas of flood plains of rivers and streams. It is subject to frequent flooding. Individual areas range from 5 to 60 acres.

Typically, the surface soil is very dark grayish brown and very dark gray sandy loam about 15 inches thick. The mottled underlying material is mainly dark gray silt loam in the upper part, very dark gray fine sandy loam in the middle part, and grayish brown loamy sand in the lower part. In places, the subsoil is finer textured to a depth of about 60 inches.

Included in mapping and making up 5 to 10 percent of the unit are small areas of somewhat poorly drained Shoals soils. These soils are on the slightly higher rises. Also included, on some small rises and knolls, are moderately well drained Abscota soils that make up 2 to 8 percent of the unit. The inclusions do not exceed 15 percent of any one delineated map unit.

Permeability of this Cohoctah soil is moderate, and surface runoff is very slow or ponded. The available water capacity is high. The surface layer is friable and easily tilled throughout a wide range of moisture conditions. The water table is at a depth of 1 foot or less during the wet season.

Most areas of this soil are left idle, are brush covered, or are used as woodland. Some areas are used as cropland if the soil is adequately drained. The soil has poor potential for cultivated crops, recreation uses, and building site developments. It has poor potential for pasture and hay. It has good potential for woodland.

If this soil is used for pasture or hay, proper stocking, pasture rotation, and restricted use during the wet season are necessary. These practices and the careful selection of grasses are needed to keep the pasture and soil in good condition. Winterkill is severe because of the flooding and frost heaving hazards. Tile drainage and flood protection devices help to reduce damage to pasture and hay.

This soil is fairly suited to trees. Equipment used for planting, tending, and harvesting trees is severely limited in kind and period of use. Expected losses of planted seedlings are more than 50 percent. Trees can be uprooted and blown down by storms when the soils are wet. Woodland operations should be conducted during seasons of the year when the soil is relatively dry or frozen. Special site preparations, such as bedding, should be used in some areas. Harvest methods that do not leave trees standing alone or widely spaced should be selected. Plans should be developed for periodic salvage of windthrown trees when needed.

Building site developments and septic tank absorption fields are not practical on these soils. The high water table and flooding are limitations that are extremely difficult to overcome.

This soil is in capability subclass Vw and Michigan soil management group L-2c.

30—Belleville loamy fine sand. This nearly level, poorly drained soil is on low, flat areas and in depressions. This soil is subject to frequent ponding. Individual areas are irregular in shape and range from 3 to 120 acres.

Typically, the surface layer is very dark grayish brown loamy fine sand about 10 inches thick. The mottled subsoil is about 20 inches thick. The upper part is light brownish gray, loose sand; the middle part is yellowish brown, loose loamy sand; and the lower part is grayish brown, loose sand. The underlying material is gray, mottled, calcareous silty clay loam to a depth of about 60 inches. In some depressional areas, the surface layer is mucky.

Included with this soil in mapping are small areas of somewhat poorly drained Rimer and Selfridge soils on slightly higher ridges and knolls. Each of these inclusions makes up 7 to 14 percent of the unit.

Permeability of this Belleville soil is rapid in the sandy subsoil and moderately slow in the loamy underlying material. Surface runoff is very slow or ponded. The available water capacity is moderate. The surface is very friable and easily tilled. The water table ranges from 1 foot above to 1 foot below the surface early in spring.

Most areas of this soil are used as cropland. Specialty crops are grown in some areas. Other areas are used as woodland or left idle. The soil has fair potential for cultivated crops, specialty crops, and most wildlife habitat. It has good potential for pasture and hay. It has poor potential for woodland, recreation uses, and building site developments and septic tank absorption fields.

The main problems of management are removing excess water and controlling soil blowing. If this soil is used for cultivated or specialty crops, underground drains for removing excess water and supplemental irrigation during drier midsummer months are beneficial. Outlets are generally hard to find. Tile needs protective covering, such as grass clippings, straw, or fiberglass, to keep it free of flowing sand and silt. Conservation tillage, winter cover crops, and windbreaks help to prevent excessive soil loss from soil blowing. Returning crop residue to the soil or the regular addition of other organic material helps to improve fertility.

Specialty crops, such as blueberries and tomatoes, are grown. Some areas of this soil are irrigated. This soil has poor air drainage and a seasonal high water table that limit the variety of crops grown. Underground drains and deep ditches are needed to help lower the water table. Grapes are grown on this soil in some areas, but the hazard of frost damage is high.

Pasture or hay crops are effective in controlling soil blowing. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during the wet season help to keep the pasture and soil in good condition.

This soil is poorly suited to use as woodland. It has a severe equipment limitation, a severe seedling mortality rate, and a moderate windthrow hazard. Woodland operations should be conducted during seasons of the year when the soil is relatively dry or frozen. Special site preparations, such as bedding, should be used in some areas. Harvest methods that do not leave trees standing alone or widely spaced should be selected.

Building site developments and septic tank absorption fields are not practical on this soil. They are generally not practical because of ponding.

This soil is in capability subclass IIIw and Michigan soil mangement group 4/2c.

31A—Kibbie loam, 0 to 3 percent slopes. This nearly level, somewhat poorly drained, sloping soil is on convex areas or in drainageways. Individual areas are irregular in shape and range from 4 to 60 acres.

Typically, the surface layer is very dark grayish brown loam about 9 inches thick. The yellowish brown, mottled subsoil is about 23 inches thick. The upper part is friable, silt loam; and the lower part is firm, silty clay loam. The mottled underlying material is light yellowish brown and yellowish brown, stratified silty clay loam, silt loam, silt, and very fine sand to a depth of about 60 inches. In places, the soil is not stratified and is finer textured in the subsoil. Some areas have sandy material over clayey or loamy material. In places, the surface layer is lighter colored.

Included with this soil in mapping are small areas of poorly drained Rensselaer and Pella soils in small depressions and natural waterways. Also included are small areas of somewhat poorly drained, more droughty Thetford soils. The inclusions each make up about 5 to 10 percent of the unit and do not exceed 15 percent of any one delineated map unit.

Permeability of this Kibbie soil is moderate, and surface runoff is slow. The available water capacity is high. The surface layer is friable and easily tilled. The water table is at a depth of 1 foot to 2 feet from the surface during winter and early in spring.

Most areas of this soil are used as cropland. Specialty crops are grown in some areas. Other areas are used as woodland or left idle. The soil has good potential for cultivated crops, specialty crops, pasture, hay, woodland, and wildlife habitat. It has fair potential for recreation uses. It has poor potential for most building site developments.

The main problems of management are preventing soil blowing, removing excess water, and maintaining organic matter content, fertility, and tilth. If cultivated crops and specialty crops are grown, underground drains are beneficial for removing excess water. Protective

covering, such as grass clippings, straw, or fiberglass mats, keep the tile free of flowing sand and silt. Conservation tillage and winter cover crops help to control soil blowing. Returning crop residue to the soil or the regular addition of other organic matter helps to improve fertility and tilth.

Specialty crops, such as apples, grapes, pears, plums, and tomatoes, are grown on this soil. Good air drainage is needed to help protect fruit crops from frost damage late in the growing season. Fruit crops need special and intensive management, such as controlling erosion by using cover crops and removing excess water by using underground drains and shallow surface ditches.

Pasture or hay crops are effective in controlling soil blowing. Proper species selection of forage crops and tile drainage can help reduce winterkill. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

The seasonal high water table is a limitation for septic tank absorption fields and building site developments. Conventional septic tank absorption fields generally are not practical on this soil. This soil can be made suitable for buildings without basements if the building site level is raised by using suitable fill material and if subsurface drainage is installed. Frost action is a limitation for local roads and streets. This limitation can be offset by replacing the upper soil layers with suitable base material. Surface drains should be used to reduce wetness.

This soil is in capability subclass IIw and Michigan soil management group 2.5b-s.

32—Pella silt loam. This nearly level, poorly drained soil is on low level plains or in depressions on broad, flat plains. It is subject to occasional ponding. Individual areas are irregular in shape and range from 3 to 600 acres.

Typically, the surface layer is black silt loam about 11 inches thick. The subsoil is gray or grayish brown, mottled, firm silty clay loam about 21 inches thick. The underlying material to a depth of about 60 inches is gray silty clay loam 5 inches thick, stratified silt loam and silty clay loam 19 inches thick, and stratified loamy sand and silt loam 4 inches thick. In places, the underlying material is sand and gravelly sand.

Included with this soil in mapping are small areas of somewhat poorly drained Kibbie soils. These soils are on slightly higher, better drained knolls and ridges. Also included are small areas of very poorly drained, mucky Palms soils in slightly depressed and ponded areas. Each of these soils makes up 4 to 8 percent of the unit. These inclusions do not exceed 15 percent of any one delineated map unit.

Permeability of this Pella soil is moderate, and surface runoff is slow to ponded. The available water capacity is high. The seasonal high water table ranges from 1 foot above to 2 feet below the surface from March to June.

Most areas of this soil are used as cropland or used for pasture. The soil has good potential for cultivated crops and pasture. It has fair to good potential for wildlife habitat. It has poor potential for woodland, recreation uses, septic tank absorption fields, and for most building site developments.

The main problems of managing this soil are ponding, frost action, and removing excess water. If this soil is used for cultivated crops, underground drains are needed for best results. During tiling operations, blinding material is needed to prevent silty material from plugging up the tile lines. Returning crop residue to the soil and staying off the soil when it is wet help to reduce crusting, increase water infiltration, and maintain good soil tilth.

Specialty crops, such as tomatoes, are grown on this soil. Some irrigation is needed. This soil has poor air drainage and a seasonal high water table that limit the variety of crops grown. Underground drains and deep ditches are needed to help lower the water table. Grapes are grown on this soil in some areas.

If this soil is used for pasture or hay, proper stocking, pasture rotation, timely deferment of grazing, and restricted use during the wet seasons are necessary. These practices and careful selection of grasses are needed to keep the pasture and soil in good condition.

This soil is poorly suited to trees. Equipment used for planting, harvesting, and tending trees is severely limited to kind and time of use. Expected losses of planted seedlings are more than 50 percent. Trees can be uprooted and blown down by storms when the soil is wet.

This soil has severe limitations for building site developments and septic tank absorption fields. Areas used for building sites should be artificially drained and protected from ponding. Dwellings and small buildings should be constructed without basements. The high water table is a limitation for dwellings that can be offset by filling sites with suitable soil material. Conventional septic tank absorption fields generally are not practical on this soil.

This soil is in capability subclass IIw and Michigan soil management group 2.5c-s.

33D—Morley silt loam, 12 to 18 percent slopes. This strongly sloping, well drained soil is on uneven, convex ridges and side slopes. Individual areas are irregular in shape and range from 3 to 25 acres.

Typically, the surface layer is dark brown silt loam about 8 inches thick. The subsoil is about 32 inches thick. The upper part is brown or dark brown, firm clay loam; and the lower part is yellowish brown, firm silty clay loam. The underlying material is pale brown, mottled silty clay loam to a depth of about 60 inches. Some areas have a sandy loam surface layer. In places, the subsoil and underlying material are coarser textured.

Included with this soil in mapping are small areas of somewhat poorly drained Blount and Rimer soils in small

depressions and natural waterways. Each makes up about 2 to 7 percent of the unit.

Permeability of this Morley soil is slow, and surface runoff is rapid. The available water capacity is high. The surface layer has a tendency to crust or become puddled after heavy rains, especially in areas where the plow layer contains subsoil material. The water table is perched at a depth of 3 to 6 feet in spring.

Most areas of this soil are used for pasture, used as woodland, or left idle. Some areas are used for cultivated crops or specialty crops. The soil has fair potential for cultivated crops, specialty crops, and wildlife habitat. It has good potential for pasture, hay, and woodland. It has poor potential for recreation uses, septic tank absorption fields, and building site development.

The major problems of management are slope, high clay content, controlling erosion, and maintaining organic matter content and soil tilth. If this soil is used for cultivated crops or specialty crops, there is a hazard of further erosion damage. Farming on the contour is a beneficial conservation practice. Conservation tillage, winter cover crops, diversions, and grassed waterways help to control excessive soil loss. Returning crop residue to the soil or the regular addition of organic material helps to improve fertility, reduce crusting, and increase water infiltration.

Areas used for specialty crops, such as peaches, are irrigated to increase production. Other specialty crops are apples and grapes. Areas used for fruit crops need special and intensive management, such as controlling erosion by using cover crops and mulch. Equipment use is limited on the steeper slopes.

Pasture and hay crops are effective in controlling erosion. Overgrazing or grazing when the soil is too wet cause surface compaction, excessive runoff, and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is well suited to use as woodland. The hazard of erosion, the equipment limitation, and seedling mortality are moderate. Regular planting and logging equipment can be used, but roads, landings, and skid trails should be carefully planned to avoid excessive erosion. Equipment should be carefully operated for safety.

This soil has severe limitations for building site developments and septic tank absorption fields. Slope is a limitation for building site developments, and slope and slow permeability are limitations for septic tank absorption fields. Slopes should be reshaped by cutting and filling, and retaining walls should be used for dwellings and small buildings. Conventional septic tank absorption fields are generally not practical on this soil. Slope and low strength are limitations for local roads and streets. Low strength can be offset by strengthening or replacing the base material.

This soil is in capability subclass IVe and Michigan soil management group 1.5a.

33E—Morley silt loam, 18 to 25 percent slopes. This moderately steep, well drained soil is on uneven convex ridges and side slopes. Individual areas are irregular in shape and range from 3 to 70 acres.

Typically, the surface layer is dark brown silt loam about 5 inches thick. The subsoil is about 33 inches thick. The upper part is brown or dark brown, firm clay loam; and the lower part is yellowish brown, firm silty clay loam. The underlying material is pale brown, mottled silty clay loam to a depth of about 60 inches. Some areas have a sandy loam surface layer. In places, the subsoil and underlying material are coarser textured.

Included with this soil in mapping are small areas of somewhat poorly drained Blount and Rimer soils in small depressions and natural waterways. Each makes up about 2 to 5 percent of the unit.

Permeability of this Morley soil is slow, and surface runoff is rapid. The available water capacity is high. The surface layer has a tendency to crust or become puddled after hard rains, especially in areas where subsoil material is exposed. The water table is perched at a depth of 3 to 6 feet in the spring.

Most areas of this soil are used as woodland or left idle. Some areas are used for pasture. The soil has poor potential for cultivated crops, specialty crops, pasture, hay, recreation uses, septic tank absorption fields, and building site developments. It has good potential for woodland. It has fair potential for wildlife habitat.

Pasture crops are effective in controlling erosion. Overgrazing or grazing when the soil is too wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is well suited to use as woodland. The hazard of erosion is moderate. Slope is a limitation for use of heavy equipment for planting, tending, and harvesting trees. Regular planting and logging equipment can be used, but roads, landings, and skid trails should be carefully planned to avoid excessive erosion. Equipment should be carefully operated for safety.

This soil has severe limitations for building site developments and septic tank disposal fields. Slope is a limitation that is extremely difficult to overcome.

This soil is in capability subclass VIe and Michigan soil management group 1.5a.

34B—Blount loam, 0 to 4 percent slopes. This nearly level and gently sloping, somewhat poorly drained soil is on convex slopes and concave areas in drainageways and depressions. Individual areas are irregular in shape and range from 3 to 640 acres.

Typically, the surface soil is dark grayish brown loam about 11 inches thick. The mottled subsoil is about 23 inches thick. The upper part is yellowish brown, firm silty clay loam; and the lower part is dark yellowish brown, firm clay. The underlying material is yellowish brown, mottled clay loam to a depth of about 60 inches. In

places, the subsoil is stratified. In some areas, the surface soil is sandy loam.

Included with this soil in mapping are small areas of somewhat poorly drained, droughtier Rimer soils on small sandy knolls and plains. These soils make up 2 to 10 percent of the unit. Also included are small areas of poorly drained Pewamo and Lenawee soils. These soils are in shallow depressions and drainageways. Each makes up 5 to 12 percent of the unit. The inclusions do not exceed 15 percent of any one delineated map unit.

Permeability of this Blount soil is slow or moderately slow. Surface runoff is medium or slow. The available water capacity is high. The surface layer is friable and easily tilled. This soil has a tendency to crust or become puddled after heavy rains, especially in areas where the plow layer contains subsoil material. The water table is perched at a depth of 1 foot to 3 feet during winter and spring months.

Most areas of this soil are used as cropland. The soil has good potential for cultivated crops, some specialty crops, hay, pasture, and woodland. It has poor potential for most building site developments and septic tank absorption fields and fair potential for recreation uses.

The main problems of management are removing excess water, preventing erosion, and maintaining fertility and soil tilth. Conservation tillage, winter cover crops, grassed waterways, and erosion control structures help to control excessive soil loss. If this soil is used for specialty crops or cultivated crops, underground drains are beneficial. Returning crop residue to the soil or the regular addition of other organic material helps to improve fertility, reduce crusting, increase water infiltration, and maintain good tilth.

Specialty crops, such as apples, grapes, pears, and plums, are grown on this soil. Good air drainage is needed to help protect fruit crops from frost damage late in the growing season. Areas used for fruit crops need special and intensive management, such as controlling erosion by using cover crops and removing excess water by using underground drains and shallow surface ditches.

Pasture or hay crops are effective in controlling erosion. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during the wet period help to keep the pasture and soil in good condition.

The seasonal high water table is a limitation for septic tank absorption fields and building site developments. Conventional septic tank absorption fields are generally not practical on this soil. The soil can be made suitable for buildings without basements if the building site level is raised by using suitable fill material and if subsurface drainage is installed. Frost action and low strength are limitations for local roads and streets. These limitations can be offset by replacing the upper soil layers with suitable base material. Surface drains should be used to reduce wetness.

This soil is in capability subclass IIw and Michigan soil management group 1.5b.

35—Aquents and Histosols, ponded. This map unit consists of nearly level soils in depressed areas along tributaries of rivers that flow into Lake Michigan and extremely wet inlands along the margins of lakes and on bottom lands. These areas have standing water or a water table at or very near the surface throughout the year. The vegetation consists of cattails, reeds, grasses, woody shrubs, and scattered clumps of water tolerant trees. The soils of these marshy areas provide habitat for waterfowl and other aquatic and semi-aquatic species of birds and mammals.

This unit consists of Histosols that formed from organic or dead vegetative material and Aquents that formed in alluvial mineral material. Access is limited on the marsh for much of the year because of standing water.

Most of these areas are useful only as habitat for waterfowl, muskrats, and other birds and animals that exist in a wetland environment.

These areas are in capability subclass VIIIw.

36—Pewamo silt loam. This nearly level, poorly drained soil is in natural drainageways and narrow to broad depressions. This soil is subject to frequent ponding. Individual areas are irregular in shape and range from 3 to 80 acres.

Typically, the surface soil is very dark grayish brown or very dark gray silt loam about 15 inches thick. The subsoil is grayish brown, mottled, firm silty clay loam about 27 inches thick. The mottled underlying material to a depth of about 60 inches is grayish brown silty clay loam 13 inches thick and gray silty clay loam 5 inches thick. In places, the underlying material is stratified.

Included with this soil in mapping are small areas of somewhat poorly drained Blount and Kibbie soils. These soils are on the higher knolls. Each makes up 5 to 10 percent of the unit. Also included are small areas of poorly drained, droughtier Belleville soils. These soils are on the same elevation as the Pewamo soil, next to sandy uplands, and make up 2 to 7 percent of the unit. The inclusions do not exceed 15 percent of any one delineated map unit.

Permeability of this Pewamo soil is moderately slow, and surface runoff is slow or ponded. The available water capacity is high. The soil has a tendency to crust or puddle after heavy rains. The water table ranges from 1 foot above to 1 foot below the surface during winter and spring months.

Most areas of this soil are used as cropland. The soil has good potential for cultivated crops, hay, pasture, and trees. It has poor potential for building site developments, septic tank absorption fields, and recreation uses.

The main problems of management are removing excess water and maintaining fertility and soil tilth. The use of farm equipment should be delayed after the wet period until the soil has dried sufficiently to prevent damage to soil structure. If this soil is used for cultivated

crops, underground drains are needed for best results. Conservation tillage, returning crop residue to the soil or the regular addition of other organic material, and staying off the soil when it is wet help to reduce crusting, increase water infiltration, and maintain good soil tilth.

Specialty crops, such as grapes, are grown in some areas of this soil. Other specialty crops are limited during most of the year by the frost hazard and excess wetness. Underground drains are needed to help lower the water table. Air drainage is poor because of the low elevation of this soil.

If this soil is used for pasture or hay, proper stocking, pasture rotation, and restricted use during the wet season are necessary. These practices and careful selection of grasses are needed to keep the pasture and soil in good condition.

This soil is well suited to trees. It has severe limitations for harvesting trees. Equipment used for planting, harvesting, and tending trees is limited as to kind and time of use. Woodland operations should be conducted during seasons of the year when the soil is relatively dry or frozen. Expected losses of planted seedlings are 25 to 50 percent. Special site preparations such as bedding should be used in some areas. Trees can be uprooted and blown down during storms when the soils are wet. Harvest methods that do not leave trees standing alone or widely spaced should be selected.

Building site developments and septic tank absorption fields are not practical on this soil. They are generally not practical because of ponding.

This soil is in capability subclass IIw and Michigan soil management group 1.5c.

37—Granby loamy fine sand. This nearly level, poorly drained soil is on low, flat plains and in drainageways and depressions. It is subject to frequent ponding. Individual areas are irregular in shape and range from 5 to 170 acres.

Typically, the surface layer is very dark brown loamy fine sand about 12 inches thick. The grayish brown and light brownish gray mottled, fine sand subsoil is about 34 inches thick. The underlying material is grayish brown, mottled fine sand to a depth of about 60 inches. In places, the subsoil is sandy loam. The surface layer is mucky sand in some areas. In other places, the surface layer is less than 10 inches thick. In some areas the surface layer is strongly acid.

Included with this soil in mapping are small areas of somewhat poorly drained Morocco and Thetford soils. These soils are on slightly higher knolls and ridges and make up 2 to 10 percent of the unit.

Permeability of this Granby soil is rapid, and surface runoff is very slow or ponded. The available water capacity is low. The water table ranges from 1 foot above to 1 foot below the surface during winter and spring months.

Most areas of this soil are used as cropland. Some areas are used as woodland or left idle. This soil has fair potential for cultivated crops and good potential for some specialty crops, such as blueberries. It has good potential for hay and pasture. It has poor potential for woodland, building site developments, septic tank absorption fields, and recreation uses.

The main problems of management are removing excess water, controlling soil blowing, maintaining fertility and organic matter content, and, if the soil is drained, conserving moisture in midsummer. If this soil is used for cultivated crops, underground drains are needed to remove excess water. Protective covering, such as straw, grass clippings, or fiberglass, keeps the tile free of flowing sand. Conservation tillage, winter cover crops, leaving crop residue on the soil, planting windbreaks, and stripcropping help to control excessive soil loss by soil blowing.

Specialty crops, such as blueberries and tomatoes, are grown. Some areas of this soil are irrigated and fertilized. Air drainage is poor, and a seasonal high water table limits the variety of crops grown. Underground drains and deep ditches are needed to help lower the water table. Grapes are grown on this soil in some areas, but the hazard of frost damage is high.

Pasture or hay crops are effective in controlling soil blowing. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during the wet season help to keep the pasture in good condition.

This soil is poorly suited to trees. Equipment used for planting, harvesting, and tending trees is severely limited to kind and time of use. Woodland operations should be conducted during seasons of the year when the soil is relatively dry or frozen. Expected loss of planted seedlings is more than 50 percent. Special site preparations, such as bedding, should be used in some areas. Trees can be uprooted and blown down during storms when the soil is wet. Harvest methods that do not leave trees standing alone or widely spaced should be selected.

Building site developments and septic tank absorption fields are not practical on this soil. They are generally not practical because of ponding.

This soil is in capability subclass IIIw and Michigan soil management group 5c.

38—Elvers silt loam. This nearly level, poorly drained or very poorly drained soil is in drainageways and depressions. It is subject to frequent ponding. Individual areas are irregular in shape and range from 2 to 20 acres.

Typically, the surface layer is dark brown, mottled silt loam about 6 inches thick. Below that is brown, mottled silt loam about 7 inches thick. The next layer is gray, mottled silt loam about 13 inches thick. The underlying material is black or dark reddish brown muck to a depth of about 60 inches.

Included are small areas of very poorly drained mucky Kerston, Edwards, and Houghton soils. These soils are in the deeper parts of the depressions and drainageways and make up 2 to 8 percent of the unit.

Permeability of this Elvers soils is moderate in the mineral material and moderately slow to moderately rapid in the organic underlying layer. Surface runoff is slow. The surface layer is friable and easily tilled. The water table ranges from 1 foot above to 1 foot below the surface during winter and spring months.

Most areas of this soil are left idle, but some areas are farmed. The soil has fair potential for cultivated crops, hay, and pasture. It has poor potential for specialty crops, woodland, septic tank absorption fields, and building site developments.

The main problems of management are removing excess water and preventing ponding. If this soil is used for cultivated crops, underground drains are needed for best results. During tiling operations, grass clippings, straw, fiberglass, or other suitable material is needed as blinding material to keep the tile from filling with sediment. Also, cradling on boards, wrapping the tile joints with burlap or tar-impregnated paper, or both, may be necessary to maintain alinement of the tile.

Specialty crops, such as blueberries and tomatoes, can be grown on this soil. Some fields are irrigated during the drier periods of the year. Areas used for these crops need special and intensive management, such as controlling the soil reaction for production of blueberries and removing the excess water by using underground drains and deep ditches for tomatoes.

If this soil is used for pasture or hay, proper stocking, pasture rotation, timely deferment of grazing, and restricted use during the wet season are necessary. These practices and careful selection of grasses are needed to keep the pasture in good condition.

This soil is poorly suited to trees. Equipment used for planting, harvesting, and tending trees is severely limited to kind and time of use. Woodland operations should be conducted during seasons of the year when the soil is relatively dry or frozen. Expected loss of seedlings is more than 50 percent. Special site preparations, such as bedding, should be used in some areas. Trees are often uprooted and blown down during storms. Harvest methods that do not leave trees standing alone or widely spaced should be selected. Plans should be developed for periodic salvage of windthrown trees when needed.

Building site developments are not practical on this soil. The high water table, ponding, and instability are limitations that are extremely difficult to overcome.

This soil is in capability subclass IIw and Michigan soil management group L-2c.

42A—Morocco loamy sand, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on irregularly shaped plains. Individual areas are irregular in shape and range from 3 to 80 acres.

Typically, the surface layer is very dark grayish brown loamy sand about 9 inches thick. The subsurface layer is pale brown, mottled sand about 8 inches thick. The yellowish brown, mottled, loose sand subsoil is about 18 inches thick. The underlying material is light brownish gray, mottled sand to a depth of about 60 inches. In places, the subsoil has bands of loamy fine sand.

Included with this soil in mapping are small areas of well drained Oakville and Plainfield soils on the top of ridges or on knolls. Also included are small areas of poorly drained Granby soils in small depressions or natural waterways. The inclusions each make up about 6 to 10 percent of the unit but do not exceed 15 percent of any one delineated map unit.

Permeability of this Morocco soil is rapid, and surface runoff is very slow. The available water capacity is low. The surface layer is very friable and easily tilled. The water table is at a depth of 1 foot to 3 feet during winter and early in spring.

Most areas of this soil are used as cropland. Specialty crops, such as asparagus and blueberries, do well. Other areas are used as woodland or left idle. The soil has fair potential for cultivated crops, specialty crops, woodland, and wildlife habitat. It has good potential for pasture and hay. It has fair to poor potential for recreation uses, septic tank absorption fields, and building site developments.

The main problems of management are controlling soil blowing, removing excess water, conserving moisture in midsummer, and maintaining fertility and organic matter content. If this soil is used for cultivated crops or specialty crops, underground drains for removing excess water and supplemental irrigation during drier midsummer months are beneficial. Tile needs protective covering, such as straw, grass clippings or fiberglass, to keep it free of flowing sand and silt. Conservation tillage, winter cover crops, and stripcropping help to prevent excessive soil loss from soil blowing. Returning crop residue to the soil or the regular addition of other organic matter helps to improve fertility and available water capacity.

Specialty crops need additional water during the growing season. Irrigation and fertilization increase the production of blueberries and tomatoes. Good air drainage is needed to help protect fruit from frost damage late in the growing season. Areas used for fruit crops need special and intensive management, such as controlling soil blowing by using cover crops and mulch. Underground drains and deep ditches are needed to help lower the seasonal high water table. Other specialty crops are apples, grapes, and asparagus.

Pasture or hay crops are effective in controlling soil blowing. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is fairly suited to use as woodland. Seedling mortality is a limitation. Special site preparations, such as furrowing before planting, should be used.

The seasonal high water table is a limitation for septic tank absorption fields and building site developments. Conventional septic tank absorption fields are generally not practical on this soil. The soil can be made suitable

for buildings without basements if the building site level is raised by using suitable fill material and if subsurface drainage is installed. Frost action is a limitation for local roads and streets. This limitation can be offset by replacing the upper soil layers with suitable base material. Surface drains should be used to reduce wetness.

This soil is in capability subclass IIIw and Michigan soil management group 5b.

44A—Coupee silt loam, 0 to 3 percent slopes. This nearly level, well drained soil is on flat broad outwash plains. Individual areas are irregular in shape and range from 160 to 700 acres.

Typically, the surface soil is very dark brown silt loam about 15 inches thick. The subsoil is about 20 inches thick. The upper part is dark brown, friable clay loam; the middle part is dark yellowish brown, friable sandy clay loam; and the lower part is dark yellowish brown, very friable sandy loam. The dark yellowish brown underlying material to a depth of about 60 inches is sand 20 inches thick and gravelly sand 5 inches thick.

Included with this soil in mapping are small areas of somewhat poorly drained Monitor soils. These soils are in shallow depressions and drainageways and make up 6 to 10 percent of the unit.

Permeability of this Coupee soil is moderate in the surface layer and subsoil and very rapid in the underlying material. Surface runoff is slow. The available water capacity is moderate. The surface layer is friable and easily tilled throughout a fairly wide range in moisture content. However, it has a tendency to crust or become puddled after hard rains.

Most areas of this soil are used as cropland. The soil has good potential for cultivated crops, specialty crops, hay, pasture, recreation uses, and most building site developments. It has fair potential for septic tank absorption fields.

The main problems of management are controlling soil blowing, conserving moisture during the dry periods, and maintaining fertility. Mulch, cover crops, windbreaks, and conservation tillage help to control soil blowing. Irrigation during the dry periods helps to relieve droughtiness and control soil blowing.

Specialty crops are suited to this soil even though few are grown. Irrigation and fertilization increase production of peaches, cherries, strawberries, and tomatoes. Good air drainage is needed to help protect fruit from frost damage late in the growing season. Apples, grapes, and asparagus can also be grown.

Pasture or hay crops are effective in controlling soil blowing. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet and dry periods help to keep the pasture and soil in good condition.

This soil is suited to building site developments. Poor filtering capacity of the underlying material is a severe limitation for septic tank absorption fields. Filling the site with suitable filter material helps to overcome this limitation. Caving of cutbanks is a limitation for shallow excavations. Trench walls should be reinforced to offset this limitaton.

This soil is in capability subclass IIs and Michigan soil management group 3/5a.

51—Houghton-Kerston mucks. This map unit consists of nearly level soils that are in depressions and drainageways on broad flood plains. These soils are subject to frequent flooding. Individual areas range from 3 to 100 acres and contain 60 to 70 percent Houghton soil and 30 to 40 percent Kerston soil. The two soils are in the same positions on the landscape and are so intricately mixed that it is not practical to separate them in mapping.

Typically, the Houghton soil has a surface layer of dark reddish brown muck about 8 inches thick. The subsoil to a depth of 60 inches is dark reddish brown or black, friable muck. In places, this soil has peat layers in the subsoil.

Typically, the Kerston soil has a surface layer of black muck about 21 inches thick. The underlying material is alternating layers of loamy, organic, and sandy material to a depth of about 60 inches. In places, the surface layer is loam or sandy loam.

Included with these soils in mapping along the edges are small areas of poorly drained Cohoctah soils that make up 5 to 15 percent of this unit.

Permeability of the Houghton soil is moderately slow to moderately rapid. Permeability of the Kerston soil is moderately slow to moderately rapid in the organic material and rapid in the underlying layers. The available water capacity is high. Surface runoff is very slow. The water table ranges from 1 foot above to 1 foot below the surface from September to June in most years.

Most areas of these soils are used as woodland or left idle. If they are drained, these soils have fair potential for cultivated crops and good potential for hay and pasture. They have poor potential for use as woodland and for recreation purposes, building site developments, and septic tank absorption fields.

The main problems affecting use as cropland are excess water, soil blowing, frost action, and flooding. If these soils are used for cultivated crops, underground drains are needed for best results. Drainage outlets are difficult to locate in many areas. Special engineering practices, such as using a drainage discharge pump, may be needed. During tiling operations, grass clippings, straw, fiberglass, or other suitable material is needed for blinding to keep tile from filling with sediment. Cradling on boards, wrapping the tile joints with burlap or tar-impregnated paper, or both, may become necessary to maintain tile alinement. When these muck soils are drained, they oxidize rapidly and the surface layer can become thinner.

Specialty crops, such as blueberries, can be grown on this soil. Excess water needs to be controlled by using

deep ditches and underground drains. If these soils are drained, they should be protected from blowing by using windbreaks. Also, soil reaction should be controlled.

If these soils are used for pasture or hay, proper stocking, pasture rotation, tile drainage, and timely deferment of grazing are necessary. These practices and careful selection of grasses are needed to keep the pasture in good condition.

These soils are poorly suited to trees. The equipment limitation, seedling mortality, and windthrow hazard are major concerns. Equipment is severely limited to kind and time of use. Woodland operations should be conducted during seasons of the year when the soils are relatively dry or frozen. Expected loss of seedlings is more than 50 percent. Special site preparations, such as bedding, should be used in some areas. Trees are often uprooted and blown down during storms. Harvest methods that do not leave trees standing alone or widely spaced should be selected. Plans should be developed for periodic salvage of windthrown trees when needed.

Building site developments and septic tank absorption fields are not practical on this soil. The high water table, ponding, and low strength are limitations that are extremely difficult to overcome.

These soils are in capability subclass IIIw and Michigan soil management group Mc, L-Mc.

52B—Abscota sandy loam, 0 to 6 percent slopes. This nearly level and gently sloping, moderately well drained soil is on large, flat areas along rivers and streams. This soil is subject to flooding. Individual areas are irregular or narrow and elongated in shape and range from 5 to 50 acres.

Typically, the surface layer is dark brown sandy loam about 10 inches thick. The mottled, loose sand subsoil is about 20 inches thick. The upper part is light gray, and the lower part is pale brown. The mottled underlying material is multicolored, calcareous sand to a depth of about 60 inches. In places, the surface layer or subsoil is loam.

Included with this soil in mapping are small areas of the moderately well drained Landes Variant soil. This soil is on the flatter areas, and makes up 2 to 7 percent of the unit. Also included are small areas of somewhat poorly drained Shoals soils. These soils are in shallow depressions and drainageways and make up 4 to 8 percent of the unit.

Permeability of this Abscota soil is rapid, and surface runoff is slow. The available water capacity is low. The surface layer is friable and easily tilled throughout a fairly wide range in moisture content. The water table is at a depth of 2-1/2 to 5 feet during the winter and spring months.

Most areas of this soil are used as cropland. Some areas are used as woodland or left idle. The soil has good potential for hay, pasture, trees, and some specialty crops, such as grapes. It has fair potential for cultivated crops and some recreation uses. It has poor potential for building site development and septic tank absorption fields.

The main problems affecting use of this soil are flooding, controlling soil blowing, conserving moisture, maintaining fertility and maintaining organic matter content. Planting cover crops or clumps of grass, conservation tillage, applying mulch, or planting windbreaks help to control excessive soil blowing and to conserve moisture. Irrigation during the dry periods helps to control droughtiness. Returning crop residue to the soil or the regular addition of other organic matter helps to improve fertility and available water capacity. Fertilizer should be carefully applied on this soil. Precautions should be taken to prevent excess fertilization that can cause stream or river pollution.

Specialty crops, such as asparagus and tomatoes, are grown on this soil. Additional water and fertilization are needed during the growing season to increase tomato production. Good air drainage is needed to help protect specialty crops from frost damage late in the growing season. Areas used for these crops need special and intensive management, such as controlling soil blowing and maintaining soil moisture.

Pasture or hay crops are effective in controlling soil blowing. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during dry periods help to keep the pasture and soil in good condition.

Building site developments and septic tank absorption fields are not practical on these soils. The high water table and flooding are limitations that are extremely difficult to overcome.

This soil is in capability subclass IVs and Michigan soil management group L-4a.

55—Edwards muck. This nearly level, very poorly drained soil is in depressions, on flat plains, and in drainageways. It is subject to frequent ponding. Individual areas are irregular in shape and range from 5 to 80 acres.

Typically, the surface layer, to a depth of about 22 inches, consists of dark reddish brown, friable muck. The underlying material is light gray marl to a depth of about 60 inches. Some areas have less than 16 inches of muck over the marl. Other places have muck deeper than 51 inches.

Permeability is moderately slow to moderately rapid in the muck layers and variable in the underlying marl. Surface runoff is very slow. The available water capacity is high. The water table ranges from 1 foot above to 1 foot below the surface during most of the year.

Most areas of this soil are farmed, but some areas are idle or in woodland. This soil has fair potential for cultivated crops and good potential for hay, pasture, and some specialty crops. It has poor potential for trees, recreation uses, septic tank absorption fields, and building site developments.

The main concerns of management are removing excess water, controlling soil blowing, and maintaining

fertility. If this soil is used for cultivated or specialty crops, underground drains are needed. Drainage outlets are difficult to locate in many areas. Special engineering practices, such as using a drainage discharge pump, may be needed. During tiling operations, grass clippings, straw, fiberglass, or other suitable material is needed to cover the tile to keep it from filling with sediment. Also, cradling on boards, wrapping the tile joints with burlap or tar-impregnated paper, or both, are generally needed to maintain alinement of the tile.

If drained, the muck oxidizes rapidly; the surface layer gets thinner, and it is subject to soil blowing. Planting clumps of grass, planting trees for windbreaks, utilizing snow fences, stripcropping, growing cover crops, or irrigating by overhead or subsurface methods greatly reduce soil losses and damage to crops caused by soil blowing.

Specialty crops, especially shallow-rooted crops, can be grown on this soil. Excess water needs to be controlled with deep ditches and underground drains. If drained, this soil needs to be protected from soil blowing by using windbreaks.

Pasture or hay crops are effective in controlling soil blowing. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet seasons help to keep the pasture in good condition.

This soil is poorly suited to trees. Equipment limitations, seedling mortality, and windthrow hazard are major concerns. Equipment is severely limited as to the kind and the time of use. Woodland operations should be conducted during seasons when the soils are relatively dry or frozen. The equipment tends to have poor traction, and ruts form quickly when this soil becomes wet. Expected loss of seedlings is more than 50 percent. Trees are often uprooted and blown down during storms. Harvest methods that do not leave trees standing alone or widely spaced should be selected. Plans should be developed for periodic salvage of windthrown trees when needed.

Building site developments are not practical on this soil. The high water table, ponding, and low strength are limitations that are extremely difficult to overcome.

This soil is in capability subclass IVw and Michigan soil management group M/mc.

56B—Martinsville fine sandy loam, 2 to 6 percent slopes. This gently sloping, well drained soil is on convex plains and knolls. Individual areas are irregular in shape and range from 4 to 150 acres.

Typically, the surface layer is brown fine sandy loam about 7 inches thick. The brown subsoil is about 31 inches thick. The upper part is friable silty clay loam, the middle part is friable clay loam, and the lower part is friable fine sandy loam. The underlying material to a depth of about 60 inches is light yellowish brown fine sand 4 inches thick and pale brown, stratified sand and loamy sand 18 inches thick. Some areas have more than 10 percent pebbles in the surface layer and subsoil and have a substratum of gravelly sand.

Included with this soil in mapping are small areas of somewhat poorly drained Kibbie soils in small depressions and natural waterways. Also included throughout are small areas of well drained Spinks and Oshtemo soils. The inclusions each make up about 5 to 12 percent of this unit and do not exceed 15 percent of any one delineated map unit.

Permeability of this Martinsville soil is moderate, and surface runoff is slow. The available water capacity is moderate. The surface layer is friable and easily tilled throughout a fairly wide range in moisture content.

Many areas of this soil are used as cropland. Specialty crops, such as peaches and cherries, are grown in some areas. Other areas are used for pasture, used as woodland, or left idle. The soil has good potential for cultivated crops, specialty crops, pasture, hay, woodland, wildlife habitat, recreation uses, septic tank absorption fields, and most building site developments.

The main problems of management are controlling soil blowing and erosion, conserving moisture during dry periods, and maintaining organic matter content. Small grain crops are better suited to this soil than corn, because they normally mature before the drier part of summer. Conservation tillage, winter cover crops, and stripcropping help control excessive soil loss from soil blowing and water erosion. Returning crop residue to the soil or the regular addition of other organic matter helps to maintain fertility and tilth.

Irrigation increases production of specialty crops, such as strawberries, cherries, peaches, and tomatoes. Good air drainage is needed to help protect fruit from frost damage late in the growing season. Areas used for fruit crops need special and intensive management, such as controlling erosion by using cover crops and mulch. Other specialty crops are apples and grapes.

Pasture or hay crops are effective in controlling soil blowing. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during dry periods help to keep the pasture and soil in good condition.

This soil is suited to building site developments and septic tank absorption fields. Frost action and low strength are limitations for local roads and streets. These limitations can be offset by replacing or covering the upper layers of the soil with suitable base material. The shrink-swell potential is a limitation for dwellings. This limitation can be offset by replacing the upper layers of the soil with suitable soil material.

This soil is in capability subclass IIe and Michigan soil management group 2.5a.

56C—Martinsville fine sandy loam, 6 to 12 percent slopes. This sloping, well drained soil is on convex ridges and knolls. Individual areas are irregular in shape and range from 5 to 50 acres.

Typically, the surface layer is brown fine sandy loam about 7 inches thick. The brown subsoil is about 31 inches thick. The upper part is friable silty clay loam, the

middle part is friable clay loam, and the lower part is friable sandy loam. The underlying material to a depth of about 60 inches is light yellowish brown fine sand 4 inches thick and pale brown stratified sand and loamy sand 18 inches thick. Some areas have more than 10 percent pebbles in the surface layer and subsoil and have a gravelly sand substratum.

Included with this soil in mapping are small areas of somewhat poorly drained Kibbie soils in small depressions and natural waterways. These soils make up about 4 to 8 percent of the unit. Also included are small areas of well drained, droughtier Spinks soils that make up about 5 to 10 percent of the unit. The inclusions do not exceed 15 percent of any one delineated map unit.

Permeability of this Martinsville soil is moderate, and surface runoff is medium. The available water capacity is moderate. The surface layer is friable and easily tilled throughout a fairly wide range in moisture content.

Many areas of this soil are used as cropland. Specialty crops are grown in some areas. Other areas are used for pasture, used as woodland, or left idle. The soil has fair potential for cultivated crops, specialty crops, recreation uses, septic tank absorption fields, and building site developments. It has good potential for pasture, hay, woodland, and wildlife habitat.

The main problems of management are slope, controlling soil blowing, water erosion, conserving moisture during dry periods, and maintaining organic matter content. Small grain crops are better suited to this soil than corn, because they normally mature before the drier part of summer and they reduce surface runoff. Conservation tillage, winter cover crops, and stripcropping help to control excessive soil loss from soil blowing and water erosion. Returning crop residue to the soil or the regular addition of other organic matter helps to improve fertility and maintain organic matter content.

Specialty crops, such as strawberries, cherries, peaches, and tomatoes, need irrigation to increase production where slopes are less restrictive. Good air drainage is needed to help protect fruit crops from frost damage late in the growing season. Areas used for fruit crops need special and intensive management, such as controlling erosion by using cover crops and mulch. Other specialty crops are apples and grapes.

Pasture or hay crops are effective in controlling soil blowing and water erosion. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during dry periods help to keep the pasture and soil in good condition.

Slope and the shrink-swell potential are limitations for dwellings. Low strength, frost action, and slope are limitations for local roads and streets. Slope is also a limitation for septic tank absorption fields. The upper layers of the soil should be replaced with suitable material to offset low strength, the shrink-swell potential, and frost action. Slopes should be reshaped by cutting and filling, and retaining walls should be used for dwellings. Absorption field tile should be installed on the contour.

This soil is in capability subclass IIIe and Michigan soil management group 2.5a.

57A—Thetford loamy sand, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on plains. Individual areas are irregular in shape and range from 3 to 200 acres.

Typically, the surface layer is dark brown loamy sand about 10 inches thick. Below that is brownish yellow and very pale brown, mottled fine sand about 21 inches thick. The next layer is pale brown, mottled fine sand with thin layers of yellowish brown loamy fine sand. In places, the thin layers are absent.

Included with this soil in mapping are small areas of excessively drained Plainfield soils and well drained Oakville and Spinks soils. These soils are on the tops of ridges or knolls, and each makes up 3 to 12 percent of the unit. Small areas of poorly drained Granby soils are also included. These soils are in small depressions and natural drainageways, and make up 2 to 8 percent of the unit. The inclusions do not exceed 15 percent of any one delineated map unit.

Permeability of this Thetford soil is moderately rapid, and surface runoff is slow. The available water capacity is low. The water table is at a depth of 1 foot to 2 feet during the wet season.

Most areas of this soil are used as cropland. Other areas are left idle or used as woodland. This soil has fair potential for cultivated crops and woodland. It has good potential for hay or pasture and some specialty crops, such as grapes, blueberries, and asparagus. It has poor potential for most building site developments and septic tank absorption fields. It has fair potential for recreation uses.

The main problems of management are removing excess water, controlling soil blowing, conserving moisture in midsummer, and maintaining organic matter content and fertility. If this soil is used for cultivated crops or specialty crops, underground drains used to remove excess water and supplemental irrigation during drier midsummer months are beneficial. Tile needs protective covering, such as straw, fiberglass, or grass clippings, to keep it free of flowing sand and silt. Conservation tillage, winter cover crops, planting windbreaks, and stripcropping help to control excessive soil loss from soil blowing. Returning crop residue to the soil or the regular addition of other organic matter helps to improve fertility and improve organic matter content.

Specialty crops need additional water during the growing season. Irrigation and fertilization increase the production of blueberries and tomatoes. Good air drainage is needed to help protect fruit from frost damage late in the growing season. Areas used for fruit crops need special and intensive management, such as controlling soil blowing by using cover crops and mulch. Underground drains and deep ditches are needed to help lower the seasonal high water table. Other specialty crops are apples, grapes, and asparagus.

Pasture and hay are effective in controlling soil blowing. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is fairly suited to trees. Expected loss of planted seedlings is 25 to 50 percent. Special site preparations, such as furrowing before planting, should be used.

The seasonal high water table is a limitation for septic tank absorption fields and building site developments. Conventional septic tank absorption fields generally are not practical on this soil. The soil can be made suitable for buildings without basements if the building site level is raised by using suitable fill material and if subsurface drainage is installed. Frost action is a limitation for local roads and streets. This limitation can be offset by replacing the upper soil layers with suitable base material. Also, surface drains help to reduce wetness.

This soil is in capability subclass IIIw and Michigan soil management group 4b.

60B—Plainfield sand, 0 to 6 percent slopes. This nearly level and gently sloping, excessively drained soil is on irregular or elongated, convex ridges and knolls. Individual areas range from 5 to 120 acres.

Typically, the surface layer is very dark gray sand about 5 inches thick. The subsoil is about 28 inches thick and is dark yellowish brown or yellowish brown, loose sand. The underlying material is light yellowish brown sand to a depth of about 60 inches. A fine sand subsoil is present in places.

Included with this soil in mapping are small areas of somewhat poorly drained Morocco and Thetford soils in small depressions or natural drainageways. Also included are small areas of well drained Spinks soils. These inclusions each make up about 7 to 14 percent of the unit, and they do not exceed 15 percent of any one delineated map unit.

Permeability of this Plainfield soil is rapid, and surface runoff is slow. The available water capacity is low. The surface layer is loose and easily tilled.

Some areas of this soil are used as cropland. Specialty crops are grown in some areas. Most areas are used as woodland, left idle, or are used for nonfarm uses. The soil has fair potential for cultivated crops, specialty crops, woodland, pasture, recreation uses, and septic tank absorption fields. It has good potential for building site developments. It has poor potential for use as wildlife habitat.

The main problems of management are controlling soil blowing, conserving moisture, and maintaining fertility and organic matter content. This soil is suited to small grain, corn, and specialty crops if it is adequately fertilized and irrigated. This soil needs more irrigation and is more susceptible to soil blowing than fine sand soils. Small grain crops are better suited to this soil than corn because they normally mature before the drier part of the year. Conservation tillage, winter cover crops, and stripcropping help to control excessive soil loss from soil blowing. Returning crop residue to the soil or the regular addition of other organic matter helps to improve fertility and the available water capacity.

Specialty crops need additional water during the growing season. Irrigation and fertilization of this soil increase the production of peaches, cherries, strawberries, and tomatoes. Good air drainage helps to protect fruit from frost damage late in the growing season. Fruit crops need special and intensive management, such as controlling soil blowing and maintaining soil moisture by using cover crops and mulch. Other specialty crops are grapes and asparagus.

Pasture or hay crops are effective in controlling soil blowing. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during dry periods keep the pasture and soil in good condition.

This soil is fairly suited to use as woodland. Expected loss of planted or natural tree seedlings, caused by dry weather conditions, can be 50 percent. Special site preparations, such as furrowing before planting, should be used.

This soil is suited to most building site developments. It is poorly suited to septic tank absorption fields and sewage lagoons because of the poor filtering capacity and seepage. Caving of cutbanks is a limitation for shallow excavations. Trench walls should be reinforced to offset this limitation. Additional water and fertilizer are needed to establish lawns.

This soil is in capability subclass IVs and Michigan group 5.3a.

61A—Whitaker loam, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is in slightly convex areas, on flat plains, and in drainageways. Individual areas are irregular in shape and range from 5 to 160 acres.

Typically, the surface layer is dark grayish brown loam about 10 inches thick. The mottled subsoil is about 28 inches thick. The upper part is grayish brown, firm silty clay loam; the middle part is yellowish brown, very friable loamy sand; and the lower part is gray, firm silty clay loam. The mottled underlying material to a depth of about 60 inches is strong brown silty clay loam 6 inches thick; yellowish brown sandy clay loam 6 inches thick; and grayish brown, stratified sandy loam, sand, and clay loam 10 inches thick. A darker surface layer is in some areas.

Included with this soil in mapping are small areas of well drained Martinsville soils. These soils are on slightly higher ridges and knolls and make up 2 to 8 percent of the unit. Also included are small areas of poorly drained Pella and Poy soils. These soils are in shallow depressions and drainageways, and each makes up 3 to 13 percent of the unit. The inclusions do not exceed 15 percent of any one delineated map unit.

Permeability of this Whitaker soil is moderate, and surface runoff is slow. The available water capacity is

high. The water table is at a depth of 1 foot to 3 feet during the wet season.

Most areas of this soil are used as cropland. The soil has good potential for cultivated crops, some specialty crops, hay, pasture, and woodland. It has fair potential for recreation uses and fair to poor potential for building site developments and septic tank absorption fields.

The main problems of management are controlling soil blowing, removing excess water, and maintaining organic matter content and soil tilth. If cultivated crops and specialty crops are grown, underground drains are needed to remove excess water. Tile needs protective covering, such as grass clippings, straw, or fiberglass mats, to keep it free of sediment. Conservation tillage, winter cover crops, windbreaks, and applying mulch help to control excessive soil loss by blowing. Returning crop residue to the soil or the regular addition of other organic matter helps to improve fertility and maintain organic matter content.

Specialty crops, such as apples, grapes, pears, plums, and tomatoes, are grown on this soil. Good air drainage is needed to help protect fruit crops from frost damage late in the growing season. Areas used for fruit crops need special and intensive management, such as controlling erosion by using cover crops and removing excess water by using underground drains and shallow surface ditches.

Pasture or hay crops are effective in controlling soil blowing. Proper species selection of forage crops and tile drainage help to prevent winterkill. Overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

The seasonal high water table is a limitation for septic tank absorption fields and building site developments. Conventional septic tank absorption fields are generally not practical on this soil. The soil can be made suitable for buildings without basements if the building site level is raised by using suitable fill material and if subsurface drainage is installed. Frost action and low strength are limitations for local roads and streets. These limitations can be offset by replacing the upper soil layer with suitable base material. Also, surface drains should be used to reduce wetness.

This soil is in capability subclass IIw and Michigan soil management group 2.5b.

62—Poy silt loam. This nearly level, poorly drained soil is on low, flat areas and in drainageways. It is subject to frequent ponding. Individual areas are irregular in shape and range from 5 to 200 acres.

Typically, the surface layer is very dark brown silt loam about 12 inches thick. The dark grayish brown, mottled, firm clay subsoil is about 10 inches thick. The mottled underlying material to a depth of about 60 inches is dark gray loamy sand 5 inches thick, light brownish gray loamy fine sand 9 inches thick, light yellowish brown fine sand 9 inches thick, and grayish brown fine sand 5 inches thick, with strata of silty clay loam. Some areas are underlain with gravelly sand and have a coarser textured subsoil.

Included with this soil in mapping are small areas of somewhat poorly drained Whitaker soils. These soils are on the slightly higher elevations and make up 5 to 13 percent of the unit.

Permeability of this Poy soil is slow or very slow in the subsoil and rapid in the underlying material. Surface runoff is very slow. The available water capacity is moderate. The water table ranges from 1 foot above to 1 foot below the surface for 6 to 8 months each year.

In adequately drained areas of this soil, cultivated crops and specialty crops are grown. A few areas are used as woodland or left idle. The soil has good potential for cultivated crops, some specialty crops, pasture, hay, and woodland. It has poor potential for recreation uses, septic tank absorption fields, and building site developments.

The main problems of management are removing excess water, controlling soil blowing, and maintaining soil tilth. If this soil is used for cultivated crops or specialty crops, underground drains are needed to remove excess water. Tile needs protective covering, such as straw, grass clippings, or fiberglass mats, to keep it free of sediment. Conservation tillage, winter cover crops, windbreaks, and applying mulch help to control excessive soil loss by soil blowing. Subsoiling can be used to break up the clay layers and make the upper part of the soil more permeable.

Specialty crops, such as tomatoes, are grown. Some areas of this soil are irrigated. This soil has poor air drainage and a seasonal high water table that limit the variety of specialty crops grown. Underground drains and deep ditches are needed to help lower the water table. Grapes are grown in some areas, but the hazard of frost damage is high.

Pasture or hay crops are effective in controlling soil blowing. Proper species selection of forage crops and tile drainage help to prevent winterkill. Overgrazing or grazing when the soil is too wet causes compaction and poor tilth. Proper stocking, pasture rotation, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is poorly suited to trees. It has a severe equipment limitation for planting, tending, and harvesting trees. Equipment is severely limited in kind and time of use. Woodland operations should be conducted during seasons of the year when the soil is relatively dry or frozen. Expected loss of planted seedlings is 25 to 50 percent. Special site preparations, such as bedding, should be used in some areas. Trees can be uprooted and blown down during storms when the soil becomes wet. Harvest methods that do not leave trees standing alone or widely spaced should be selected.

Building site developments and septic tank absorption fields are not practical on this soil. They are generally not practical because of ponding.

This soil is in capability subclass IIw and Michigan soil management group 1/5c.

63B—Metea loamy sand, 1 to 6 percent slopes. This nearly level and gently sloping, well drained soil is on convex ridgetops, knolls, and side slopes. Individual areas are irregular in shape and range from 5 to 40 acres.

Typically, the surface layer is dark brown loamy sand about 8 inches thick. The subsurface layer, about 26 inches thick, is yellowish brown loamy sand and the subsoil, about 7 inches thick, is dark brown, friable sandy loam in the upper part and yellowish brown, mottled, firm clay loam in the lower part. The underlying material is yellowish brown, mottled clay loam to a depth of about 60 inches. Some areas have sandy underlying material and bands of loamy fine sand in the subsoil.

Included with this soil in mapping are small areas of somewhat poorly drained Selfridge soils in small depressions and natural waterways. These inclusions make up 5 to 10 percent of the unit.

Permeability of this Metea soil is very rapid in the sandy subsoil and moderate or moderately slow in the loamy underlying material. Surface runoff is slow. The available water capacity is moderate. The surface layer is very friable and easily tilled.

Many areas of this soil are used as cropland. Specialty crops are grown in some areas. Other areas are used as woodland or left idle. The soil has fair potential for cultivated crops, specialty crops, recreation uses and wildlife habitat. It has good potential for use as woodland and for pasture and hay. It has fair or good potential for most building site developments and has fair potential for septic tank absorption fields.

The main problems of management are controlling soil blowing, conserving soil moisture during dry periods, and maintaining soil fertility and organic matter content. Winter cover crops, applying mulch, planting windbreaks, irrigating during dry periods, and grass seeding or sodding and fertilizing help to control excessive soil loss caused by soil blowing and help to conserve moisture. Returning crop residue to the soil or the regular addition of other organic matter helps to improve fertility and maintain organic matter content.

Specialty crops need additional water during the growing season. Irrigation and fertilization increase production of peaches, cherries, strawberries, and tomatoes. Good air drainage helps to protect fruit from frost damage late in the growing season. Areas used for fruit crops need special and intensive management, such as controlling soil blowing by using cover crops and mulch and maintaining soil moisture. Other specialty crops are apples, grapes, and asparagus.

Pasture or hay crops are effective in controlling soil blowing. Supplemental irrigation is beneficial for the best crop growth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during dry periods help to keep the pasture and soil in good condition.

This soil is well suited to use as woodland. The expected loss of planted seedlings ranges from less than 25 percent to 50 percent. Special site preparations, such as furrowing before planting, should be used.

This soil is well suited to building site developments. It is poorly suited to septic tank absorption fields and sewage lagoons. Caving of cutbanks is a limitation for shallow excavations. Trench walls should be reinforced to offset this limitation. The moderately slow permeability is a limitation in septic tank absorption fields. Adding suitable filter material to the absorption field site helps overcome this limitation. Seepage is a limitation for lagoons. This limitation can be offset by covering the sides of the lagoon with impervious material.

This soil is in capability subclass IIIe and Michigan soil management group 4/2a.

63C—Metea loamy sand, 6 to 12 percent slopes. This sloping, well drained soil is on convex ridges and side slopes. Individual areas are irregular in shape and range from 5 to 20 acres.

Typically, the surface layer is dark brown loamy sand about 8 inches thick. The subsurface layer, about 26 inches thick, is yellowish brown loamy sand and sand. The subsoil, about 7 inches thick, is dark brown, friable sandy loam in the upper part and yellowish brown, mottled, firm clay loam in the lower part. The underlying material is yellowish brown, mottled clay loam to a depth of about 60 inches. Some areas have sandy underlying material and bands of loamy fine sand in the subsoil.

Included with this soil in mapping are small areas of somewhat poorly drained Selfridge soils in small depressions and natural drainageways. These inclusions make up about 3 to 7 percent of this unit.

Permeability of this Metea soil is very rapid in the sandy subsoil and moderate or moderately slow in the loamy underlying material. Surface runoff is slow. The available water capacity is moderate. The surface layer is very friable and easily tilled.

Many areas of this soil are used as cropland. Specialty crops are grown in some areas. Other areas are used as woodland, left idle, or are in nonfarm uses. The soil has fair potential for cultivated crops, specialty crops, recreation uses, wildlife habitat, septic tank absorption fields, and building site developments. It has good potential for use as woodland and for pasture and hay.

The main problems of management are slope, controlling soil blowing, conserving soil moisture, maintaining soil fertility and organic matter content, and controlling erosion. Planting winter cover crops, applying mulch, planting windbreaks, irrigating during dry periods, grass seeding, and using grassed waterways and diversions help to control excessive soil loss caused by soil blowing and water erosion. This helps conserve

moisture during the dry midsummer months. Returning crop residue to the soil or regular additon of other organic matter helps to improve fertility and maintain organic matter content.

Specialty crops need additional water during the growing season. Irrigation and fertilization increase the production of peaches, cherries, strawberries, and tomatoes. Areas used for fruit crops need special and intensive management, such as controlling soil blowing and water erosion by using cover crops and mulch. Maintaining soil moisture is also important. Other specialty crops are apples, grapes, and asparagus.

Pasture or hay crops are effective in controlling soil blowing. Supplemental irrigation is beneficial for best crop results. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during dry periods help to keep the pasture and soil in good condition.

This soil is well suited to use as woodland. The expected loss of planted seedlings ranges from less than 25 percent to 50 percent. Special site preparations, such as furrowing before planting should be used.

This soil is suited to building site developments. It is poorly suited to septic tank absorption fields and sewage lagoons. Caving of cutbanks is a limitation for shallow excavations. Trench walls should be reinforced to offset this limitation. The moderately slow permeability is a limitation in septic tank absorption fields. Adding suitable filter material to the absorption field site helps overcome this limitation. Seepage is a limitation for lagoons. This limitation can be offset by covering the sides of the lagoon with impervious material.

This soil is in capability subclass IIIe and Michigan soil management group 4/2a.

64A—Selfridge loamy sand, 0 to 3 percent slopes. This nearly level, somewhat poorly drained soil is on slightly convex plains, knolls, and short, uneven side slopes. Individual areas are irregular in shape and range from 5 to 80 acres.

Typically, the surface layer is very dark grayish brown loamy sand about 9 inches thick. The subsurface layer, about 23 inches thick, is pale brown and light brownish gray, mottled loamy sand. The subsoil, about 8 inches thick, is strong brown, friable sandy loam in the upper part and strong brown, mottled friable clay loam in the lower part. The underlying material is grayish brown, mottled loam to a depth of about 60 inches. Some areas have finer textured underlying material. In places, loamy underlying material is not present.

Included with this soil in mapping are small areas of somewhat poorly drained Crosier soils. These soils are on small knolls and ridges and make up 2 to 12 percent of this unit. Also included are small areas of well drained Metea soils. These soils are on the crest of knolls and ridges and make up 4 to 10 percent of the unit. Small areas of poorly drained Belleville soils are also included. These soils are in drainageways and shallow depressions and make up 2 to 12 percent of the unit. The inclusions do not exceed 15 percent of any one delineated map unit.

Permeability of this Selfridge soil is rapid in the sandy subsoil and moderate or moderately slow in the underlying material. Surface runoff is slow or very slow. Available water capacity is moderate. The water table is at a depth of 1 foot to 2 feet during the wet season.

Most areas of this soil are cultivated. Other areas are used as woodland, left idle, or used for pasture. This soil has fair potential for cultivated crops, specialty crops, and woodland. It has good potential for hay and pasture. This soil has fair potential for recreation uses and poor potential for most building site developments and septic tank absorption fields.

The main problems of management are removing excess water, controlling soil blowing, and maintaining fertility and organic matter content. Applying mulch, growing cover crops, seeding to grass or sodding and fertilizing, and irrigating during dry periods help to control soil blowing. Returning crop residue to the soil or the regular addition of organic material help to improve soil fertility and maintain organic matter content. If row crops and specialty crops are grown, underground drains are needed for the best results. Tile needs protective covering, such as straw, grass clippings, or fiberglass mats, to keep it free of sediment.

Specialty crops need additional water during the growing season. Irrigation and fertilization increase the production of blueberries and tomatoes. Good air drainage is needed to help protect fruit from frost damage late in the growing season. Areas used for fruit crops need special and intensive management, such as controlling soil blowing by using cover crops and mulch. Underground drains and deep ditches are needed to help lower the seasonal high water table. Other specialty crops are apples, grapes, and asparagus.

Pasture or hay crops are effective in controlling soil blowing. Proper stocking, pasture rotation, and timely deferment of grazing during wet or dry periods help to keep the pasture and soil in good condition.

This soil is fairly suited to trees. Expected loss of planted seedlings is 25 to 50 percent. Special site preparations, such as furrowing before planting, should be used.

The seasonal high water table is a limitation for septic tank absorption fields and building site developments. Conventional septic tank absorption fields generally are not practical on this soil. This soil can be made suitable for buildings without basements if the building site level is raised by using suitable fill material and if subsurface drainage is installed. Frost action is a limitation for local roads and streets. This limitation can be offset by replacing the upper soil layers with suitable base material. Also, surface drains should be used to reduce wetness.

This soil is in capability subclass IIIw and Michigan soil management group 4/2b.

65F—Udorthents and Udipsamments, 18 to 90 percent slopes. These moderately steep to very steep,

well drained soils are on steep bluffs and in deep, narrow gullylike areas along the Lake Michigan beach and areas bordering the flood plains of rivers and connecting tributaries (fig. 13). Individual areas are very irregular and elongated in shape and range from 25 to 250 acres. Slopes range from 18 to 90 percent, but are dominantly between 30 and 90 percent. They range from 15 to 350 feet in length, and differences in elevation, from the top of the slope to the bottom, range from about 5 to 200 feet.

Included with these soils in mapping are many of the soils in the county. These included soils are on the tops of the cliffs and make up 2 to 10 percent of the unit. Mucky soils are present on many of the steep, wet areas where there are seeps.

These Udorthents and Udipsamments range from clay to sand. Surface runoff is very rapid.

Most areas of these soils are left idle or are wooded. The soils have poor potential for cultivated crops, pasture, woodland, recreation uses, wildlife habitat, or building site developments.

The main limitation is the very steep slopes. The main problem of management is controlling erosion. The excessive slope is a severe limitation for cropland,

Figure 13.—High water levels and wave action cause the steep bluffs along Lake Michigan to crumble and slide into the lake, carrying trees and sometimes houses down to the beach below.

pasture, or commercial woodland. The soils should be left in permanent vegetation. If these soils are exposed, as in raw clifflike banks, vegetation is needed to help control further erosion.

These soils are very poorly suited to building site developments. The hazard of erosion is severe, and sloughing and landslides are common. Along Lake Michigan, high water levels result in the undercutting of these soils by wave action. This action causes sloughing and landslides, and in many areas it has caused houses that were built overlooking Lake Michigan to topple into the lake.

These soils are in capability subclass VIIe.

66A—Landes Variant silt loam, 0 to 3 percent slopes. This nearly level and gently sloping, well drained and moderately well drained soil is on large flat areas and small elongated areas along rivers and streams. This soil is subject to rare flooding. Individual areas range from 5 to 50 acres.

Typically, the surface layer is very dark grayish brown silt loam, about 10 inches thick. The dark brown and dark yellowish brown, friable very fine sandy loam subsoil is about 30 inches thick. The underlying material, to a depth of about 60 inches, is pale brown mottled silt loam.

Included with this soil in mapping are small areas of somewhat poorly drained Shoals soils in small depressions and natural waterways. These make up about 5 to 10 percent of the unit.

Permeability of this Landes Variant soil is moderately rapid or rapid, and surface runoff is slow. The available water capacity is high. The surface layer is friable and easily tilled. The water table is at a depth of 3 to 6 feet during the spring months.

Many areas of this soil are cultivated. Specialty crops are grown in some areas. Other areas are used as woodland or left idle. The soil has fair potential for cultivated crops, specialty crops, pasture, hay, woodland, wildlife habitat, and recreation uses. It has poor potential for building site developments and septic tank absorption fields.

The main problem of management is controlling soil blowing. Flooding rarely occurs and is of brief duration. If this soil is used for cultivated crops or specialty crops, there is a hazard of soil blowing. Winter cover crops, applying mulch, planting windbreaks, irrigating during dry periods, and seeding to grass or sodding and fertilizing help to control excessive soil loss by soil blowing. Returning crop residue to the soil or the regular addition of other organic matter help to improve fertility and maintain organic matter content.

Specialty crops, such as tomatoes, are grown. The soil needs to be irrigated and fertilized during the growing season. Good air drainage is needed to help protect specialty crops from frost damage late in the growing season. Areas used for these crops need special and intensive management, such as controlling soil blowing and maintaining soil moisture.

Pasture or hay crops are effective in controlling soil blowing. Proper stocking, pasture rotation, timely deferment of grazing and restricted use during dry periods help to keep the pasture and soil in good condition.

This soil is well suited to trees. Undesirable shrubs and trees may delay establishment and growth of desirable trees.

Building site developments and septic tank absorption fields are not practical on this soil. The high water table and flooding are limitations that are extremely difficult to overcome.

This soil is in capability class I and Michigan soil management group L-2a.

67A—Shoals silt loam, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on broad, flat areas of flood plains and bottom lands along streams and rivers. It is subject to occasional flooding. Individual areas are irregular in shape and range from 5 to 160 acres.

Typically, the surface layer is dark grayish brown silt loam about 9 inches thick. The multicolored underlying material is silt loam in the upper part, loamy very fine sand and fine sandy loam in the middle part, and sand and gravel in the lower part to a depth of about 60 inches. In some places, the surface layer is calcareous.

Included with this soil in mapping are small areas of moderately well drained Abscota and Landes Variant soils. These soils are on the higher knolls and ridges, and each makes up 2 to 12 percent of the unit. Also included are small areas of very poorly drained Cohoctah soils. These soils are in shallow depressions and drainageways and make up 5 to 11 percent of the unit. The inclusions do not exceed 15 percent of any one delineated map unit.

Permeability of this Shoals soil is moderate. The available water capcity is high. Surface runoff is very slow. The water table is at a depth of 1 foot to 3 feet during the winter and spring months.

Most areas of this soil are used as cropland, but some areas are left idle or used as woodland. The soil has good potential for crops, hay, pasture, and woodland. It has poor potential for building site developments and septic tank absorption fields. It has fair to poor potential for recreation uses.

The main problems of management are removing excess water, controlling soil blowing, and controlling flooding. If this soil is used for cultivated crops, underground drains are needed for the best results. During tiling operations, blinding material, such as grass clippings, fiberglass mats, or straw, is needed to keep flowing sand from plugging the tile. Conservation tillage, cover crops, and using mulch help to control excessive soil loss by blowing.

Specialty crops, such as tomatoes, are grown. This soil is irrigated and fertilized during the growing season. Good air drainage is needed to help protect specialty

crops from frost damage late in the growing season. Areas used for these crops need special and intensive management, such as using underground drains and deep ditches to lower the seasonal high water table.

Pasture or hay crops are effective in controlling soil blowing. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is well suited to trees. Tree seedlings survive and grow well if competing vegetation is controlled or removed.

Building site developments and septic tank absorption fields are not practical on this soil. The high water table and flooding are limitations that are extremely difficult to overcome.

This soil is in capability subclass IIw and Michigan soil management group L-2c.

68A—Granby-Morocco complex, 0 to 3 percent slopes. This map unit consists of the nearly level, poorly drained Granby soil and the somewhat poorly drained Morocco soil on broad to narrow lake plains and former beach ridges. The Granby soil is subject to frequent ponding. Most areas of these soils are elongated and near the dunes of Lake Michigan. Individual areas range from 20 to 200 acres. This map unit is 50 to 55 percent Granby soil and 35 to 45 percent Morocco soil. The Granby soil is on the lower flat areas, and the Morocco soil is on the higher convex knolls and ridges. The two soils are so intricately mixed or so small in size that it is not practical to separate them in mapping.

Typically, the Granby soil has a surface layer of very dark brown loamy fine sand about 12 inches thick. The grayish brown, mottled, loose fine sand subsoil is about 34 inches thick. The underlying material is grayish brown, mottled fine sand to a depth of about 60 inches. In places, the surface layer is mucky sand or muck.

Typically, the Morocco soil has a surface layer of very dark grayish brown loamy sand about 9 inches thick. The subsurface layer is pale brown, mottled sand about 8 inches thick. The yellowish brown, mottled, loose sand subsoil is about 18 inches thick. The underlying material is light brownish gray, mottled sand to a depth of about 60 inches.

Included with these soils in mapping are small areas of well drained Oakville soils and very poorly drained, mucky Adrian soils. Oakville soils are on the higher ridges and on tops of the higher knolls. Adrian soils are in the lower depressions near the Granby soil. The included soils make up 5 to 15 percent of this unit.

Permeability is rapid for the Granby and Morocco soils. The available water capacity is low. Surface runoff is very slow or ponded for the Granby soil and very slow for the Morocco soil. In the Granby soil, the water table ranges from 1 foot above to 1 foot below the surface during the winter and spring months. In the Morocco soil, the water table is at a depth of 1 foot to 3 feet in winter and early in spring.

Most areas of these soils are idle brushland and second-growth woodland. Some areas are used for specialty crops. These soils have fair potential for cultivated crops and specialty crops, such as blueberries, and for woodland and wildlife habitat. They have good potential for pasture and hay. The Morocco soil has fair to poor potential for recreation uses, septic tank absorption fields, and building site developments. The Granby soil has poor potential for these uses.

The soils in this unit are suited to wildlife habitat and woodland. The major problems for these uses are ponding, soil blowing, and excess water. The Morocco soil is generally droughty during the midsummer months. The Granby soil is subject to frequent ponding early in spring. If these soils are cleared and used for crops, conservation tillage, winter cover crops, leaving crop residue on the surface, windbreaks, and stripcropping help to control excessive soil loss caused by soil blowing.

In some areas, specialty crops, such as blueberries and tomatoes, are grown. These crops need to be irrigated and fertilized. The soils have poor air drainage and a seasonal high water table that limit the variety of crops grown. Underground drains and deep ditches are needed to help lower the water table. Grapes are grown on these soils in some areas, but the hazard of frost damage is high.

Pasture or hay crops are effective in controlling soil blowing. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

The Granby soil is poorly suited to trees. Equipment limitations, seedling mortality, and windthrow hazard are major concerns. Equipment used for planting, harvesting, and tending trees is severely limited as to kind and time of use. Woodland operations should be conducted during the seasons of the year when the soils are relatively dry or frozen. Trees are uprooted and blown down by wind when the soils are wet. Harvest methods that do not leave trees standing alone or widely spaced should be selected. The Morocco soil is fairly suited to use as woodland, however, seedling mortality is a limitation. Special site preparations, such as furrowing before planting, should be used.

These soils have severe limitations for building site developments and septic tank absorption fields. Areas used for building sites should be artificially drained and protected from ponding. Dwellings and small buildings should be constructed without basements. The base material should be strengthened and drainage should be used for local roads and streets. Lagoons should be constructed above ground by diking the sides and blanketing bottom and sides with impervious material.

This complex is in capability subclass Vw and Michigan soil management group 5c, 5b.

69B—Plainfield-Urban land complex, 0 to 6 percent slopes. This map unit consists of nearly level and gently

sloping, excessively drained soils and Urban land. Individual areas range from 350 to 1,300 acres. This map unit is 50 to 65 percent Plainfield soil and similar soils and 20 to 35 percent Urban land. The soils are so intricately mixed with Urban land, or areas are so small in size, that it is not practical to separate them in mapping.

Typically, the Plainfield soil has a surface layer of very dark gray sand about 5 inches thick. The subsoil is about 28 inches thick and is dark yellowish brown or yellowish brown, loose sand. The underlying material is light yellowish brown sand to a depth of about 60 inches. In places the subsoil has strata of fine sand or loamy fine sand.

Urban land is covered by streets, parking lots, driveways, sidewalks, buildings, and other structures that obscure or alter the soil so that identification is not feasible.

Included with the soil and Urban land in mapping are small areas of somewhat poorly drained Morocco and Thetford soils. These soils are in shallow depressions and drainageways, and each make up 2 to 7 percent of the unit.

Permeability is rapid in the Plainfield soil. Surface runoff is slow. The available water capacity is low.

The Plainfield soil is used for parks, open spaces, building sites, lawns, gardens, orchards, vineyards, or specialty crops, or is woodland. It has fair to good potential for lawns, vegetable and flower gardens, trees, and shrubs. This soil has good potential for most building site developments and fair potential for recreation uses.

This Plainfield soil is well suited to grasses, flowers, vegetables, trees, and shrubs. Fertilization and irrigation are needed. Perennial plants selected for planting should be tolerant of drought. Soil blowing generally is not a major problem on this soil, unless the soil is left in a bare, exposed condition for a considerable period of time. If the soil is exposed for extended periods, temporary cover should be provided. Annual grasses, sod, mulch, asphalt spray, and netting provide temporary cover and protect the soil.

The Plainfield soil is suited to most building site developments. Caving of cutbanks is a limitation for shallow excavations. Trench walls should be reinforced to offset this limitation. All sanitary facilities should be connected to commerical sewers and treatment systems to prevent possible pollution of shallow water supplies.

This complex is not assigned to an interpretive group.

70A—Thetford-Urban land complex, 0 to 3 percent slopes. This map unit consists of nearly level, somewhat poorly drained soils and Urban land. Individual areas range from 40 to 620 acres. This map unit is 60 to 70 percent Thetford soil and similar soils and 20 to 30 percent Urban land. The soils are so intricately mixed with the Urban land, or areas are so small in size, that it is not practical to separate them in mapping.

Typically, the Thetford soil has a surface layer of dark brown loamy sand about 10 inches thick. The next layer, about 21 inches thick, is brownish yellow and very pale brown, mottled fine sand. Below that is pale brown, mottled, loose fine sand with thin layers of yellowish brown loamy fine sand to a depth of about 60 inches. In places, there is no loamy fine sand, banded subsoil. Also, in places the surface layer is more than 10 inches thick and is darker than typical.

Urban land is covered by streets, parking lots, sidewalks, driveways, buildings, and other structures that obscure or alter the soil so that identification is not feasible.

Included with the soil and Urban land in mapping are small areas of very poorly drained Gilford soils and poorly drained Granby soils. These soils are in small depressions and drainageways and make up 5 to 10 percent of the unit. Small areas of well drained Spinks soils and excessively drained Plainfield soils are also included. These soils are on the crest of small knolls and make up 2 to 8 percent of the unit.

Some areas of this map unit are artificially drained by sewer systems, gutters, drainage tiles, and surface ditches. If the Thetford soil is not drained, it has a water table at a depth of 1 foot during the wet season. Some low lying areas are ponded because of runoff from adjacent, higher areas or because of a high water table.

Permeability is moderately rapid in the Thetford soil. Surface runoff is slow, and the available water capacity is low.

The Thetford soil is used for parks, open spaces, building sites, lawns, gardens, vineyards, orchards, and specialty crops. It has fair potential for lawns, vegetable and flower gardens, and trees and shrubs. It has poor potential for most building site developments and fair potential for most recreation uses.

The Thetford soil is well suited to grasses, flowers, vegetables, trees, and shrubs. The main limitations are soil blowing and excess water. Several methods of artificial drainage can be used on this soil. The best method for a particular area should be selected on the basis of onsite investigation. Perennial plants selected for planting should be tolerant of wetness. If areas of soil are exposed, soil blowing should be controlled by applying mulch, asphalt spraying, and seeding to grass or sodding and fertilizing. During the midsummer months, watering gardens and lawns is beneficial, especially in areas where the soil is artificially drained.

The high water table and caving cutbanks are severe limitations for building site developments. Dwellings and small commercial buildings should be constructed without basements. Subsurface drainage should be installed to lower the water table. Trench walls should be reinforced to prevent caving cutbanks of shallow excavations. All sanitary facilities should be connected to commercial sewers and treatment systems.

This complex is not assigned to an interpretive group.

71—Pits. This map unit consists of open excavations from which soil and underlying sand or gravel material

have been removed. The exposed underlying material supports few or no plants. The outer edges of these excavations have steep vertical side slopes. Pits commonly have been excavated to a depth below the water table. Areas range from 3 to 80 acres.

Some of the Pits have been a source of sand for industrial use in making glass and as foundry sand. Other Pits have been a source of gravel and sand for roads and streets and for concrete. Where ponds have been created from the Pits, many species of wildlife use them as watering holes. A few Pits may contain small deposits of rubbish and trash. Onsite investigation is needed before any use is made of the Pits.

This map unit is not assigned to an interpretive group.

72B—Udipsamments and Udorthents, 0 to 6 percent slopes. This map unit consists of soils that are the result of cutting and filling land. The original ridges have been leveled. The lower, wetter, and poorly drained depressions and pot holes have been filled. Some of these depressions and pot holes have been filled with soil material that has been borrowed from nearby construction sites, dumped, and leveled. These soils range from sand to clay. In some areas there is a slight darkening of the surface caused by grass roots and other decaying vegetation.

Areas of these soils are used mainly as sites for recreation, industry, and residential development. Some areas are left idle or used for wildlife habitat. A few areas may contain small deposits of rubbish and garbage. Onsite investigation is needed before any use is made of these areas. Some areas are suited to residential development, industrial development, recreation uses, and wildlife habitat.

These soils are not assigned to an interpretive group.

75B—Rimer-Urban land complex, 0 to 4 percent slopes. This map unit consists of nearly level and gently sloping, somewhat poorly drained soils and Urban land. Individual areas range from 50 to 480 acres. This map unit is 60 to 70 percent Rimer soil and similar soils and 20 to 30 percent Urban land. The soils are so intricately mixed with the Urban land, or areas are so small in size, that it is not practical to separate them in mapping.

Typically, the Rimer soil has a surface layer of very dark grayish brown loamy sand about 9 inches thick. The subsurface layer, about 23 inches thick, is pale brown and yellowish brown, mottled loamy fine sand and fine sand. The subsoil is gray, firm clay about 9 inches thick. The underlying material is yellowish brown, mottled clay to a depth of about 60 inches. In places, the underlying material is coarser textured.

Urban land is covered by streets, parking lots, driveways, buildings, and other structures that obscure or alter the soil so that identification is not feasible.

Included with the soil and Urban land in mapping, and making up 5 to 12 percent of the unit, are small areas of moderately well drained Glynwood soils and well drained Tustin soils. These soils are on higher, convex areas in the landscape. Also included are small areas of poorly drained Belleville and Pewamo soils. These soils are in shallow depressions and drainageways, and each makes up 2 to 6 percent of the unit.

Permeability of the Rimer soil is rapid in the sandy subsoil and very slow in the underlying material. Surface runoff is slow. The available water capacity is moderate. Most areas of this map unit are artificially drained by sewer systems, gutters, drainage tiles, and, to a lesser extent, surface ditches. Where the Rimer soil is not drained, it has a perched water table at a depth of 1/2 foot to 2 feet during wet seasons.

The Rimer soil, or the open part of the map unit, is used for parks, open space, building sites, lawns, gardens, orchards, and specialty crops. This soil has good potential for lawns, vegetable and flower gardens, trees, and shrubs. It has poor potential for most building site developments and fair potential for recreation uses.

The Rimer soil is well suited to grasses, flowers, vegetables, trees, and shrubs if the excess water is removed. Several methods of artificial drainage can be used on this soil. The best method for a particular area should be selected after onsite investigation. Perennial plants selected for planting should have a fairly high tolerance for wetness. Erosion generally is not a major limitation on this soil, unless the soil is disturbed and left in a bare, exposed condition. Leaving the soil unprotected can result in the blowing of the sandy subsoil and the runoff of clay material into local drainage systems.

The Rimer soil has severe limitations for building site developments. The high water table is a limitation for dwellings and small commercial buildings. Caving cutbanks is a limitation for shallow excavations. Dwellings and small commercial buildings should be constructed without basements and subsurface drainage should be installed to lower the water table. Trench walls should be reinforced to prevent caving cutbanks of shallow excavations. All sanitary facilities should be connected to commercial sewers and treatment systems. Frost action is a limitation for local roads and streets. This limitation can be offset by replacing or covering the upper soil layers with suitable base material.

This complex is not assigned to an interpretive group.

76—Urban land. This map unit consists of areas of urban land on nearly level plains. Individual areas range from 20 to 100 acres.

Areas of this unit are mainly covered by streets, sidewalks, parking lots, driveways, buildings, and other structures that obscure or alter the soils so that indentification is not feasible.

Included in mapping, and making up 0 to 15 percent of the unit, are small areas of Ockley, Oshtemo, Rimer, and Blount soils. These soils are around buildings and used as lawns, or they are in other areas that have not been covered over. Also included are short slopes that are

more than 2 percent. These inclusions do not exceed 15 percent of any one map unit.

Onsite investigation is needed before suitable management practices can be selected.

This map unit is not assigned to an interpretive group.

77B—Oshtemo-Urban land complex, 0 to 6 percent slopes. This map unit consists of nearly level and gently sloping, well drained soils and Urban land. Individual areas range from 40 to 1,200 acres. This map unit is 60 to 70 percent Oshtemo soil and 15 to 30 percent Urban land. The Oshtemo soil is so intricately mixed with the Urban land, or areas are so small in size, that it is not practical to separate them in mapping.

Typically, the Oshtemo soil has a surface layer of dark grayish brown sandy loam about 8 inches thick. The subsoil is about 43 inches thick. The upper part is dark brown and dark reddish brown, friable sandy loam; the middle part is dark brown, very friable loamy sand; and the lower part is yellowish brown, loose sand with thin strata of dark brown, loose loamy sand. In places, the subsoil has bands of loamy fine sand and fine sand. In some areas, the surface layer is silt loam or loam. Some of the low areas have been filled and leveled during construction, and other places have been cut and smoothed. Some areas have a sand or loamy sand surface layer more than 20 inches thick.

Urban land is covered by streets, parking lots, driveways, buildings, sidewalks, and other structures that obscure or alter the soil so that identification is not feasible.

Included with this soil and Urban land in mapping are small areas of somewhat poorly drained Monitor and Brady soils. These soils are in shallow depressions and drainageways, and each makes up 2 to 7 percent of the unit.

Permeability of the Oshtemo soil is moderately rapid in the upper part of the subsoil and very rapid in the lower part. Surface runoff is slow. The available water capacity is moderate.

The Oshtemo soil, or the open part of the map unit, is used for parks, open spaces, building sites, lawns, gardens, orchards, and specialty crops. The soil has good potential for lawns, vegetable and flower gardens, trees, and shrubs. It has good potential for most building site developments and recreation uses.

The Oshtemo soil is well suited to grasses, flowers, vegetables, trees, and shrubs. It should be fertilized and irrigated. Perennial plants selected for planting should be tolerant of drought. Erosion generally is not a major limitation, unless the soil is left in a bare exposed condition for a considerable period of time. If extended periods of exposure are unavoidable, temporary cover should be provided. Annual grasses, sod, mulch, asphalt spray, and netting provide temporary cover and protect the soil.

The Oshtemo soil is suited to most building site developments. Caving cutbanks is a severe limitation for shallow excavations. Trench walls should be reinforced to offset this limitation. All sanitary facilities should be connected to commercial sewers and treatment systems to prevent possible pollution of shallow water supplies.

This complex is not assigned to an interpretive group.

78B—Riddles-Oshtemo complex, 1 to 6 percent slopes. This map unit consists of nearly level and gently sloping, well drained soils on convex ridgetops, knolls, and plains. Individual areas are irregular in shape and range from 20 to 200 acres. This map unit is 50 to 65 percent Riddles soil and 35 to 55 percent Oshtemo soil. These soils are so intricately mixed that it is not practical to separate them in mapping.

Typically, the Riddles soil has a surface layer of dark brown loam about 7 inches thick. The dominantly yellowish brown, friable or firm sandy clay loam subsoil is about 48 inches thick. The underlying material is dark yellowish brown, mottled loam to a depth of about 63 inches. Some areas have sand or sand and gravelly sand underlying material. Also, some areas have a finer textured subsoil.

Typically, the Oshtemo soil has a surface layer of dark grayish brown sandy loam about 8 inches thick. The subsoil is about 43 inches thick. The upper part is dark brown and dark reddish brown, friable sandy loam; the middle part is dark brown, very friable loamy sand; and the lower part is yellowish brown, loose sand with thin strata of dark brown, loose loamy sand. Some areas have a sand or loamy sand surface layer more than 20 inches thick.

Included with these soils in mapping, and each making up 5 to 15 percent of the unit, are small areas of somewhat poorly drained Crosier and Monitor soils. The Crosier and Monitor soils are in concave foot slopes, depressions, and along waterways. These inclusions do not exceed 15 percent of any one delineated map unit.

Permeability is moderate in the Riddles soil. Permeability of the Oshtemo soil is moderately rapid in the upper part of the subsoil and very rapid in the lower part. Surface runoff is slow for the Oshtemo soil and medium for the Riddles soil. The available water capcity is high for the Riddles soil and moderate for the Oshtemo soil. The surface layer is friable and easily tilled. The Riddles soil has a tendency to crust or puddle after heavy rains, especially in areas where the plow layer contains subsoil material.

Most areas of these soils are used for crops. The Riddles soil has good potential for cultivated crops. The Oshtemo soil has fair potential for cultivated crops, specialty crops, hay, pasture, recreation uses, and woodland. Both soils have fair to good potential for most building site developments and septic tank absorption fields.

The main problems affecting use of these soils are water erosion, soil blowing, and droughtiness. Conservation tillage, winter cover crops, and grassed waterways help to control water erosion and soil blowing

and to maintain organic matter content. Returning crop residue to the soil or the regular addition of other organic material helps to improve fertility and reduce crusting and water infiltration in the Riddles soil and helps to increase available water capacity in the Oshtemo soil.

Areas used for specialty crops, such as strawberries, cherries, peaches, and tomatoes, are irrigated and fertilized to increase production. Good air drainage is needed to help protect fruit crops from frost damage late in the growing season. Areas used for fruit crops need special and intensive management, such as controlling erosion on the Riddles soil and controlling soil blowing and maintaining soil moisture on the Oshtemo soil by using cover crops and mulch. Other specialty crops are apples and grapes.

Pasture or hay crops are effective in controlling erosion. Overgrazing or grazing when the soil is too wet can cause surface compaction, excessive runoff, and poor tilth on the Riddles soil. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

The soils in this complex are suited to most building site developments and septic tank absorption fields. In areas of the Riddles soil, the shrink-swell potential is a limitation for dwellings and small commercial buildings, and frost action and low strength are limitations for local roads and streets. The upper layers of the soil should be replaced with suitable fill material to offset frost action, the shrink-swell potential, and low strength. In areas of the Oshtemo soil, caving of cutbanks is a limitation for shallow excavations, and the poor filtering capacity is a limitation for septic tank absorption fields. Trench walls should be reinforced to offset caving of cutbanks. Septic tank absorption fields should be installed in areas of the Riddles soil if possible.

This complex is in capability subclass IIe and Michigan soil management group 2.5a, 4a.

78C—Riddles-Oshtemo complex, 6 to 12 percent slopes. This map unit consists of sloping, well drained soils on convex ridgetops, knolls, and short uneven side slopes. Individual areas are irregular in shape and range from 12 to 100 acres. This map unit is 50 to 65 percent Riddles soil and 35 to 55 percent Oshtemo soil. These soils are so intricately mixed that it is not practical to separate them in mapping.

Typically, the Riddles soil has a surface layer of dark brown loam about 6 inches thick. The subsoil is about 46 inches thick. The upper part is light yellowish brown, friable sandy clay loam; the middle part is yellowish brown, firm clay loam; and the lower part is yellowish brown, friable sandy clay loam. The underlying material is yellowish brown loam to a depth of about 63 inches. Some areas have a finer textured subsoil or have sand or sand and gravel underlying material.

Typically, the Oshtemo soil has a surface layer of dark grayish brown sandy loam about 7 inches thick. The subsoil is about 40 inches thick. The upper part is dark brown and dark reddish brown, friable sandy loam; the middle part is dark brown, very friable loamy sand; and the lower part is yellowish brown, loose sand with thin strata of dark brown, loose loamy sand. In places, the subsoil has bands of loamy sand and fine sand. Some areas have a sand or loamy sand surface layer more than 20 inches thick.

Included with these soils in mapping, and each making up 5 to 15 percent of the unit, are small areas of somewhat poorly drained Crosier and Monitor soils. The Crosier and Monitor soils are on concave foot slopes, in depressions, and along waterways. These inclusions do not exceed 15 percent of any one delineated map unit.

Permeability of the Riddles soil is moderate. Permeability of the Oshtemo soil is moderately rapid in the upper part of the subsoil and very rapid in the lower part. Surface runoff is medium for the Riddles soil and slow for the Oshtemo soil. The available water capacity is high for the Riddles soil and moderate for the Oshtemo soil. The surface layer is friable and easily tilled. The Riddles soil has a tendency to crust or puddle after heavy rains, especially in areas where the plow layer contains subsoil material.

Most areas of these soils are used for crops. These soils have fair potential for cultivated crops; good potential for hay, pasture, woodlands, and specialty crops; and fair potential for recreation uses, septic tank absorption fields, and most building site developments.

The main problems of management for the Riddles soil are slope, controlling soil erosion, and maintaining fertility and organic matter content. In the Oshtemo soil, the main problems of management are controlling soil blowing and conserving moisture during the midsummer months. Conservation tillage, winter cover crops, mulch, and grassed waterways help to maintain organic matter content and help to control water erosion and soil blowing. Returning crop residue to the soil or the regular addition of other organic material helps to improve fertility, reduce crusting in the Riddles soil, and increase water infiltration and available water capacity in the Oshtemo soil.

Areas used for specialty crops, such as strawberries, cherries, peaches, and tomatoes, are irrigated and fertilized to increase production. Good air drainage is needed to help protect fruit crops from frost damage late in the growing season. Areas used for fruit crops need special and intensive management, such as controlling erosion on the Riddles soil and maintaining soil moisture in the Oshtemo soil by using cover crops and mulch. Other specialty crops are apples and grapes.

Pasture or hay crops are effective in controlling erosion. Overgrazing or grazing the Riddles soil when it is too wet can cause surface compaction, excessive runoff, and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

These soils are suited to most building site developments and septic tank absorption fields. In the Riddles soil, shrink-swell potential and slope are limitations for dwellings and small commercial buildings; frost action and low strength are limitations for local roads and streets. The upper layers of the soil should be replaced with suitable fill material to offset frost action, shrink-swell potential, and low strength. In the Oshtemo soil, caving of cutbanks is a limitation for shallow excavations; poor filtering capacity is a limitation for septic tank absorption fields; and slope is a limitation for building site developments. Trench walls should be reinforced to offset caving cutbanks. Septic tank absorption fields should be installed in areas of the Riddles soil if possible. Also, absorption field tile should be installed on the contour. Slopes should be reshaped by cutting and filling, and retaining walls should be used for building site developments.

This complex is in capability subclass IIIe and Michigan soil management group 2.5a, 4a.

78D—Riddles-Oshtemo complex, 12 to 18 percent slopes. This map unit consists of strongly sloping, well drained soils on convex ridgetops, knolls, and steep side slopes. Individual areas are elongated and irregular in shape and range from 10 to 75 acres. This map unit is 50 to 65 percent Riddles soils and 35 to 55 percent Oshtemo soils. These soils are so intricately mixed that it is not practical to separate them in mapping.

Typically, the Riddles soil has a surface layer of dark brown loam about 7 inches thick. The subsoil is about 42 inches thick. The upper part is light yellowish brown, friable clay loam; the middle part is yellowish brown, firm clay loam; and the lower part is yellowish brown, friable sandy clay loam. The underlying material is yellowish brown to a depth of about 63 inches. In some areas, the surface layer is less than 6 inches thick. Some areas have a finer textured subsoil or have sand or sand and gravel underlying material.

Typically, the Oshtemo soil has a surface layer of dark grayish brown sandy loam about 5 inches thick. The subsoil is about 35 inches thick. The upper part is dark brown and dark reddish brown, friable sandy loam; the middle part is dark brown, very friable loamy sand; and the lower part is yellowish brown, loose sand with thin strata of dark brown, loose loamy sand. In places, the subsoil has bands of loamy fine sand and fine sand. Some areas have a sand or loamy sand surface layer more than 20 inches thick.

Included with these soils in mapping, and making up 2 to 7 percent of the unit, are small areas of somewhat poorly drained Crosier and Monitor soils. The Crosier and Monitor soils are on concave foot slopes, in depressions, and in areas along waterways. These inclusions do not exceed 15 percent of any one delineated map unit.

Permeability of the Riddles soil is moderate. Permeability of the Oshtemo soil is moderately rapid in the upper part of the subsoil and very rapid in the lower part. Surface runoff is rapid for the Riddles soil and medium for the Oshtemo soil. The available water capacity is high for the Riddles soil and moderate for the Oshtemo soil. The surface layer is friable and easily tilled. The Riddles soil has a tendency to crust or puddle after heavy rains, especially in areas where the plow layer contains subsoil material.

Some areas of these soils are used for crops. Other areas are used as woodland or left idle. These soils have fair potential for cultivated crops. They have good potential for hay, pasture, woodland, and specialty crops. They have fair to poor potential for recreation uses, septic tank absorption fields, and building site developments.

The main problems of management are slope, controlling erosion, and maintaining fertility and organic matter content. In the Oshtemo soil, other problems of management are controlling soil blowing and conserving moisture during the midsummer months. Conservation tillage, winter cover crops, mulch, grassed waterways, and diversions help to maintain organic matter content and to control water erosion and soil blowing. Erosion control structures are helpful for controlling gully erosion. Returning large amounts of crop residue to the soil or the regular addition of large amounts of other organic material helps to improve fertility, to reduce crusting in the Riddles soil, and to increase water infiltration and available water capacity in the Oshtemo soil.

Specialty crops on these soils are apples, peaches, and grapes. Irrigation and fertilization increase production of peaches. Equipment use is limited on the steeper slopes. Fruit crops need special and intensive management, such as controlling erosion and maintaining soil moisture on the Oshtemo soil by using cover crops and mulch.

Pasture or hay crops are effective in controlling erosion. Overgrazing or grazing when the Riddles soil is too wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

These soils are poorly suited to building site developments because slope is a limitation. Buildings should be designed to complement the slope. Local roads and streets should be constructed on the contour and land forming should be used to offset this limitation. Septic tank absorption fields are not practical because of the slope.

This complex is in capability subclass IVe and Michigan soil management group 2.5a, 4a.

80—Cohoctah-Urban land complex. This map unit consists of a nearly level, poorly drained soil and Urban land on the low flat river bottoms and flood plains near Lake Michigan. This soil is subject to frequent flooding. Individual areas of this unit range from 40 to 500 acres.

This map unit is 50 to 80 percent Cohoctah soil and 25 to 35 percent Urban land. The Cohoctah soils and Urban land are so intricately mixed or areas are so small in size that it is not practical to separate them in mapping.

Typically, the Cohoctah soil has a surface layer of very dark grayish brown sandy loam about 15 inches thick. The mottled subsurface layer is grayish brown, very friable loamy sand about 3 inches thick. The mottled underlying material is dark gray, very dark gray, and grayish brown silt loam, fine sandy loam, loamy sand, and fine sand to a depth of about 60 inches. In places, a finer textured subsoil is present. In some areas there is 20 to 60 inches of muck over the underlying sandy and loamy material.

Urban land is covered by streets, parking lots, buildings, and other structures that obscure or alter the soils and supporting material so that identification is not feasible. Some areas consist of a collection of debris, such as solid industrial wastes, discarded concrete slabs, pillars, boards, and other discarded building materials. This debris has been dumped and pushed into the marshy alluvial flood plains. In places, it is supporting buildings, roads, and streets.

Permeability of this Cohoctah soil is moderately rapid, and surface runoff is very slow or ponded. The available water capacity is high.

This soil is poorly suited to grasses, flowers, vegetables, trees, and shrubs. Because of the nature of the underlying material, artificial drainage is difficult. The water table is very near the surface, and outlets are difficult to find. Flooding is a major problem.

Building site developments are not practical on these soils. The high water table and flooding are limitations that are extremely difficult to overcome.

This complex is not assigned to an interpretive group.

82B—Oshtemo-Ockley complex, 0 to 4 percent slopes. This map unit consists of nearly level and gently sloping, well drained soils on flat to slightly convex plains and deltas. Individual areas are irregular in shape and range from 20 to 720 acres.

This map unit is 40 to 60 percent Oshtemo soils and 25 to 40 percent Ockley soils. The two soils are so intricately mixed, or so small in size, that it is not practical to separate them in mapping.

Typically, the Oshtemo soil has a surface layer of dark grayish brown sandy loam about 8 inches thick. The subsurface layer, about 2 inches thick, is dark yellowish brown loamy fine sand. The subsoil is about 50 inches thick. The upper part is dark brown and dark reddish brown, friable sandy loam; the middle part is dark brown, very friable loamy sand; and the lower part is yellowish brown, loose sand with thin strata of dark brown, loose loamy sand. In places, the subsoil has bands of loamy fine sand and fine sand. Some areas have a sand or loamy sand surface layer more than 20 inches thick.

Typically, the Ockley soil has a surface layer of dark grayish brown loam about 9 inches thick. The dominantly dark brown subsoil is about 36 inches thick. The upper part is gravelly clay loam, the middle part is gravelly sandy clay loam and sandy loam, and the lower part is loamy sand. The underlying material is dark yellowish brown, loamy and gravelly coarse sand to a depth of about 60 inches.

Included with these soils in mapping are small areas of somewhat poorly drained Brady and Monitor soils. These inclusions are in shallow depressions and drainageways, and each makes up 3 to 10 percent of the unit.

Permeability of the Oshtemo soil is moderately rapid in the upper part of the subsoil and very rapid in the lower part. Permeability of the Ockley soil is moderate. The available water capacity is moderate for the Oshtemo and Ockley soils. Surface runoff is slow. The surface layer of the Oshtemo soil is loose or friable and easily tilled. The surface layer of the Ockley soil is friable and easily tilled throughout a fairly wide range in moisture content.

Most areas of these soils are used for crops, but some areas are left idle or used for non-farm purposes. The Oshtemo soil has fair potential and the Ockley soil has good potential for cultivated crops. Both have good potential for hay, pasture, orchards, and other specialty crops. They have good potential for most building site developments and fair to good potential for septic tank absorption fields.

The main concerns of management are controlling soil blowing, maintaining fertility, and conserving moisture. Conservation tillage and winter cover crops help to control soil blowing and maintain organic matter content. Irrigating cropland helps to reduce soil blowing and droughtiness. Returning crop residue to the soil or the regular addition of other organic material helps to improve fertility and the available water capacity.

Specialty crops need additional water during the growing season. Production of peaches, cherries, tomatoes, and strawberries is increased if the soils are irrigated and fertilized. Good air drainage is needed to help protect fruit from frost damage late in the growing season. Areas used for fruit crops need special and intensive management, such as controlling soil blowing and maintaining soil moisture on the Oshtemo soil and controlling erosion on the Ockley soil by using cover crops and mulch. Other specialty crops are apples, grapes, cucumbers, and asparagus.

Pasture or hay is effective in controlling soil blowing. Overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

These soils are suited to most building site developments. Caving of cutbanks is a limitation for shallow excavations. Trench walls should be reinforced to offset this limitation. Poor filtering capacity is a limitation for septic tank absorption fields on the

Oshtemo soil. The Ockley soil should be used for this purpose. On the Ockley soil, the shrink-swell potential is a limitation for dwellings and small commercial buildings, and low strength is a limitation for local roads and streets. These limitations can be offset by replacing the upper layers of the soil with suitable base material.

This complex is in capability subclass IIIe and Michigan soil management group 4a, 2.5a.

use and management of the soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavior characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

crops and pasture

Harvey Belter, county agent for fruit, Cooperative Extension Service, assisted in the preparation of this section.

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Soil Conservation Service is explained (*10*); and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed soil map units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

According to the U.S. Census of Agriculture (*12*), more than 150,000 acres in the survey area was used for crops and pasture in 1974. Of this total, 8,400 acres was used for permanent pasture; 53,000 acres was used for row crops, mainly corn and soybeans; 15,000 acres was used for close-grown crops, mainly wheat and oats; 10,000 acres was used for hay crops; 41,500 acres was used for specialty crops, mainly peaches, apples, pears, cherries, grapes, plums, tomatoes, and asparagus; and the rest was idle cropland or woodland.

Soil drainage is the major management concern for about half of the acreage that is used for crops and pasture. Drainage of cropland improves the air-water relationship in the root zone. Spring planting, spraying, and harvesting are delayed and weed control is more difficult where drainage is poor. Properly designed tile drains or surface drainageways, or both, can be used to remove excess water. Some soils are naturally so wet that the production of crops common to the area generally is not possible.

Unless artificially drained, the very poorly drained, poorly drained, and somewhat poorly drained soils are so wet that crops are damaged in most years. Examples of these soils are Belleville, Crosier, Pipestone, Granby, Pella, Selfridge, and Pewamo soils.

Riddles, Martinsville, and Ockley soils have good natural drainage most of the year, but they tend to dry slowly after rain. Small areas of wetter soils along drainageways and in swales are commonly included in some areas of these soils, especially where slopes are 2 to 6 percent. Artificial drainage is needed in some of these wetter areas.

The design of surface and subsurface drainage systems varies with the kind of soil. A combination of surface drainage and tile drainage is needed in most areas of poorly drained and very poorly drained soils that are used for intensive row cropping. Drains need to be more closely spaced in soils that have slow permeability than in the more permeable soils. Tile drainage is slow or very slow in Pewamo and Lenawee soils. Finding

adequate outlets for tile drainage systems is difficult in many areas of Cohoctah, Adrian, Granby, Pella, Houghton, and Shoals soils. Diversions may be used in some areas to divert surface runoff from wet areas. Good soil tilth and an ample supply of organic matter also help soil drainage. The low-lying areas are subject to a shortened growing season because of frost late in spring and early in fall.

Organic soils oxidize and subside when their pore space is filled with air; therefore, special drainage systems are needed to control the depth and period of drainage. Maintaining the water table at the level required by crops during the growing season and raising it to the surface during other times of the year minimizes the oxidation and subsidence of organic soils. Information on drainage design for each kind of soil is available in local offices of the Soil Conservation Service.

Soil erosion, including soil blowing, is the major hazard on about one-half of the cropland in Berrien County. Where slopes are more than 2 percent, water erosion is a hazard. Riddles and Martinsville soils, for example, have slopes of 2 to 12 percent.

Loss of the surface layer by erosion is damaging for two reasons. First, productivity is reduced as the surface layer is lost and part of the subsoil is incorporated into the plow layer. Loss of the surface layer is especially damaging on soils that have a clayey subsoil, such as the Morley soils. Erosion also reduces productivity on soils that tend to be droughty, such as Spinks and Oshtemo soils. Second, erosion on farmland results in sediment entering streams. Controlling erosion minimizes stream pollution by sediment and improves the quality of water for municipal and recreation uses, for fish, and for wildlife habitat.

In many sloping areas, preparing a good seedbed and tilling are difficult on loamy spots, because the original friable surface layer has been eroded. Such spots are common in the sloping areas of Riddles and Metea soils.

Erosion control practices provide a protective cover for the surface layer, reduce runoff, and increase infiltration. A cropping system that keeps vegetative cover on the soil for extended periods can hold erosion losses to amounts that do not reduce the capacity of the soils. On livestock farms, where pasture and hay are needed, the legume and grass forage crops in the cropping system reduce erosion on sloping land and provide nitrogen and improve tilth for the following crop.

Terraces and diversions reduce runoff, erosion, and the length of slope. They are most practical on deep, well drained soils that have regular slopes. Most soils in Berrien County are suitable for diversions but not for terraces because of irregular slopes, excessive wetness in the terrace channels, a clayey subsoil which would be exposed in terrace channels, or excessive droughtiness.

Contouring and contour stripcropping are also useful erosion control practices. They are best adapted to soils that have smooth, uniform slopes, such as a few areas of the sloping Riddles and Martinsville soils. In most areas, the slopes are too short and too irregular.

Soil blowing is a hazard on the sandy Oakville, Oshtemo, Selfridge, Brady, Metea, Morocco, Pipestone, Spinks, Rimer, Tustin, and Plainfield soils and on the mucky Houghton, Edwards, Palms, and Adrian soils. Soil blowing can damage these soils in a few hours, especially the muck soils, if the winds are strong and if the soils are dry and the surface layer is bare of vegetation or mulch. Maintaining a vegetative cover, conservation tillage, tree or shrub windbreaks, buffer strips, or rough surfaces minimize soil blowing.

Slopes are so short and irregular that contour tillage or terracing is not practical in most areas of the sloping Riddles, Martinsville, or Spinks soils. On these soils, cropping systems that provide substantial vegetative cover are needed to control erosion, unless conservation tillage is practiced. Minimizing tillage and leaving crop residue on the surface help to increase water infiltration and reduce runoff and erosion. Grassed waterways can be used to help control erosion and the formation of gullies.

No tillage for corn, which is increasingly common, is effective in reducing erosion on sloping land and can be adapted to some of the soils in the survey area. It is more difficult, however, to successfully practice no tillage on soils that have a clayey surface layer. No tillage leaves crop residue on the soil as a mulch which reduces soil blowing and water erosion. This allows high yields of corn in areas that had been considered marginal in their production because of erosion.

Good management is necessary for satisfactory crop production with any tillage system. No tillage requires the use of different skills for planting and for insect and weed control. Proper time for planting, selection of herbicides that are suited to the present vegetation, control of insects, adequate nutrients, and selection of tillage systems based on soil characteristics are important management requirements.

On muck soils, windbreaks of such adapted shrubs as Tatarian honeysuckle or silky dogwood are effective in reducing soil blowing. Control of the water table and use of grain for buffer strips are also effective in minimizing soil blowing.

Information about the design of erosion control practices for each kind of soil is available in local offices of the Soil Conservation Service.

Soil fertility is naturally medium to high in loamy soils and low in most sandy soils on the uplands. The soils on flood plains, such as Cohoctah, Abscota, Landes Variant, and Shoals soils, range from slightly acid to mildly alkaline and are naturally higher in plant nutrients than most soils on the uplands.

Many sandy soils naturally range from strongly acid to slightly acid. If lime has never been applied, the soils require applications of ground limestone to raise the pH level sufficiently for good growth of alfalfa and other crops that grow only on almost neutral soils. Available

phosphorus and potash levels are naturally low to medium in most of these soils. On all soils, additions of lime and fertilizer should be based on the results of soil tests, on the need of the crop, and on the expected level of yields. The Cooperative Extension Service can help in determining the kinds and amounts of fertilizer and lime to apply (*7*).

Soil tilth is an important factor in germination of seeds and in infiltration of water into the soil. Soils that have good tilth are granular and porous.

Some of the soils that are used for crops have a loamy surface layer that is light in color and low in organic matter content. Generally, the structure of such soils is weak, and intense rainfall causes the surface to crust. If the crust forms, infiltration is reduced and runoff is increased. Regular additions of crop residue, manure, and other organic material can help to improve soil tilth and to reduce crust formation.

The darker colored Pewamo, Poy, and Lenawee soils are clayey, and tilth is difficult to maintain because the soils stay wet until late in spring. If these soils are wet when plowed, they tend to be very cloddy when dry, the subsoil compacts, and good seedbeds are difficult to prepare. Growing cover crops and green manure crops, proper use of crop residue, conservation tillage, and the application of livestock manure help maintain and improve organic matter content and tilth. Fall plowing at the proper moisture content, on nearly level, poorly drained or somewhat poorly drained soils, can reduce damage to tilth and allow tillage earlier the following spring. Fall plowing should not be done on sloping soils or on soils that are subject to soil blowing. Grazing on wet, loamy and clayey soils should be avoided because it results in compaction of the soil and poor tilth. Good management practices are needed if an intensive cropping system or continuous cultivation exists.

Field crops suited to the soils and climate of the survey area include a few that presently are not commonly grown. Corn, soybeans, and grain sorghum are the row crops commonly grown in Berrien County. Sunflowers, potatoes, and similar crops can be grown if economic conditions are favorable.

Wheat and oats are common close-grown crops. Rye, barley, and buckwheat are not as common but have good potential. Grass seed can be produced from brome, fescue, reed canarygrass, and bluegrass. Alfalfa and red clover with grass mixtures are the common hayland crops, with great possibilities for expanded acreage in the survey area.

Specialty crops grown commercially in the survey area are peaches, cherries, apples, pears, plums, grapes, blueberries, strawberries, sweet corn, asparagus, tomatoes, peppers, and cucumbers. A small acreage is used for potatoes, raspberries, currants, and a few other vegetables. The climate is favorable for intensive fruit production. Temperatures are moderated because the county is in close proximity to Lake Michigan. The winds are dominantly westerly or southwesterly, which delays bud swelling and bloom in spring by keeping the temperatures lower. The temperatures remain higher in fall, delaying the early killing frost.

Deep soils that have good natural drainage and that warm early in spring are especially well suited to many vegetables and small fruits. These are Oshtemo, Ockley, Spinks, Tustin, Abscota, Martinsville, and Metea soils where slopes are less than 6 percent. Also, if they are irrigated, Oakville and Plainfield soils that have slopes of less than 6 percent are well suited to vegetables and small fruits. Crops generally can be planted and harvested earlier on these soils than on the other soils in the survey area.

Orchards, vineyards, and berry patches represent a big investment, and the sites for fruit crops should be carefully selected in order to assure profitable returns from capital and labor input. In selecting a site for fruit crops, soils and local climate should be considered. Experience has shown that some soils are better suited to fruit production than others, mainly because of differences in air temperature within short distances. Soils determine management practices, tree or plant growth, length of productive life of a fruit tree or plant, and the productivity of the orchard, vineyard, or berry patch. Local climate affects fruit set, pollination by bees, the number of blossoms per tree or plant, and frost damage to parts of plants and woody parts of trees.

If adequate drainage and adequate protection from soil blowing are provided, the muck soils are well suited to sod, blueberries, and a wide range of vegetable crops. Houghton, Edwards, Palms, and Adrian muck soils are examples.

Most of the well drained soils in the survey area are suitable for orchards and nursery plants. Soils in low areas where frost action is frequent and air drainage is poor, however, generally are poorly suited to early vegetables, small fruits, and orchards. Fruit and vegetable crops require special and very intensive management, such as controlling erosion, maintaining soil moisture, and precise timing of operations in order to obtain high yields and maintain productive fruit sites. Irrigation of fruit and vegetable crops is very beneficial on most soils in the survey area. It provides frost protection and increases yields by providing additional moisture if rainfall is not adequate.

Latest information and suggestions for growing specialty crops can be obtained from local offices of the Cooperative Extension Service and the Soil Conservation Service.

yields per acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in tables 6 and 7. Field crops are shown in table 6, and specialty crops are shown in table 7. In any given year, yields may be higher or lower than those indicated in the tables because of variations in rainfall and other climatic factors.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green-manure crops; and harvesting that insures the smallest possible loss.

For yields of irrigated crops, it is assumed that the irrigation system is adapted to the soils and to the crops grown, that good quality irrigation water is uniformly applied as needed, and that tillage is kept to a minimum.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in tables 6 and 7 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils.

land capability classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops (*9*). Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor does it consider possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for woodland, and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit. Only class and subclass are used in this survey.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have slight limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation.

The acreage of soils in each capability class and subclass is shown in table 8. The capability subclass and Michigan soil management group (*8*) of each map unit are given in the section "Detailed soil map units."

In the map units of soil complexes, the soil management groups are listed in the same order as the named series. The soils are grouped according to needs for lime and fertilizer, artificial drainage, and other practices.

woodland management and productivity

Table 9 can be used by woodland owners or forest managers in planning the use of soils for wood crops (fig. 14). Only those soils suitable for wood crops are listed. The table lists the ordination (woodland suitability) symbol for each soil. Soils assigned the same ordination symbol require the same general management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for important trees. The number 1 indicates very high productivity; 2, high; 3, moderately high; 4, moderate;

Figure 14.—Small woodlots on Morocco loamy sand produce needed timber and provide extra income. Trees provide needed cover and habitat for wildlife.

and 5, low. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *x* indicates stoniness or rockiness; *w*, excessive water in or on the soil; *t*, toxic substances in the soil; *d*, restricted root depth; *c*, clay in the upper part of the soil; *s*, sandy texture; *f*, high content of coarse fragments in the soil profile; and *r*, steep slopes. The letter *o* indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: x, w, t, d, c, s, f, and r.

In table 9, *slight, moderate,* and *severe* indicate the degree of the major soil limitations to be considered in management.

Ratings of the *erosion hazard* indicate the risk of loss of soil in well managed woodland. The risk is *slight* if the expected soil loss is small, *moderate* if measures are needed to control erosion during logging and road construction, and *severe* if intensive management or special equipment and methods are needed to prevent excessive loss of soil.

Ratings of *equipment limitation* reflect the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. A rating of *slight* indicates that use of equipment is not limited to a particular kind of equipment or time of year; *moderate* indicates a short

seasonal limitation or a need for some modification in management or in equipment; and *severe* indicates a seasonal limitation, a need for special equipment or management, or a hazard in the use of equipment.

Seedling mortality ratings indicate the degree to which the soil affects the mortality of tree seedlings. Plant competition is not considered in the ratings. The ratings apply to seedlings from good stock that are properly planted during a period of sufficient rainfall. A rating of *slight* indicates that the expected mortality is less than 25 percent; *moderate*, 25 to 50 percent; and *severe*, more than 50 percent.

Ratings of *windthrow hazard* are based on soil characteristics that affect the development of tree roots and the ability of the soil to hold trees firmly. A rating of *slight* indicates that a few trees may be blown down by normal winds; *moderate*, that some trees will be blown down during periods of excessive soil wetness and strong winds; and *severe*, that many trees are blown down during periods of excessive soil wetness and moderate or strong winds.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index*. This index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Commonly grown trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

Trees to plant are those that are suited to the soils and to commercial wood production.

windbreaks and environmental plantings

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, hold snow on the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. To insure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

Table 10 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 10 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service or from a nursery.

recreation

The soils of the survey area are rated in table 11 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 11, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 11 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 14 and interpretations for dwellings without basements and for local roads and streets in table 13.

Camp areas require site preparation such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking, horseback riding, and bicycling should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

wildlife habitat

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 12, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, brome, clover, alfalfa, birdsfoot trefoil, crownvetch, and orchardgrass.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, goldenrod, beggarweed, wheatgrass, and grama.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, the available water capacity, and wetness. Examples of these plants are oak, poplar, cherry, sweetgum, apple, hawthorn, hickory, blackberry, and blueberry. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are autumn-olive, crabapple, honeysuckle, gray dogwood, silky dogwood, highbush cranberry, and Washington hawthorn.

Coniferous plants furnish browse, seeds, and cones. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, spruce, cedar, and juniper.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, wildrice, rushes, sedges, and reeds.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface

stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include bobwhite quail, pheasant, meadowlark, field sparrow, cottontail rabbit, and red fox.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include wild turkey, ruffed grouse, woodcock, thrushes, woodpeckers, tree squirrels, gray fox, raccoon, and white-tailed deer.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, shore birds, muskrat, and mink.

engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

building site development

Table 13 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing

or caving is affected by soil texture and the depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock or to a cemented pan, the available water capacity in the upper 40 inches, and the content of salts, sodium, and sulfidic materials affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

sanitary facilities

Table 14 shows the degree and the kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 14 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to a cemented pan, and flooding affect absorption of the effluent. Large stones or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to effectively filter the effluent. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 14 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of

landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 14 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, and soil reaction affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

construction materials

Table 15 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a probable or improbable source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 15, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches

of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

water management

Table 16 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas; embankments, dikes, and levees; and aquifer-fed ponds. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders or organic matter. A high water table affects the amount of usable material. It also affects trafficability.

Aquifer-fed excavated ponds are pits or dugouts that extend to a ground-water aquifer or to a depth below a permanent water table. Excluded are ponds that are fed only by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Excavated ponds are affected by depth to a permanent water table, permeability of the aquifer, and quality of the water as inferred from the salinity of the soil. Depth to bedrock and the content of large stones affect the ease of excavation.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity in the root zone. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to a cemented pan. The performance of a system is affected by the depth of the root zone, and soil reaction.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large

stones, wetness, slope, and depth to a cemented pan affect the construction of grassed waterways. A hazard of wind erosion, low available water capacity, restricted rooting depth, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

soil properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

engineering index properties

Table 17 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil series and their morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains particles coarser than sand, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (*1*).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as Pt. Soils exhibiting engineering properties of two groups can have a dual classification, for example, SP-SM.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an oven-dry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

physical and chemical properties

Table 18 shows estimates of some characteristics and features that affect soil behavior. These estimates are

given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, and plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earth-moving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3 bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to wind erosion in cultivated areas. The groups indicate the susceptibility of soil to wind erosion and the amount of soil lost. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.

2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible. Crops can be grown if intensive measures to control wind erosion are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control wind erosion are used.

5. Loamy soils that are less than 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control wind erosion are used.

6. Loamy soils that are 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible. Crops can easily be grown.

7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible. Crops can easily be grown.

8. Stony or gravelly soils and other soils not subject to wind erosion.

Organic matter is the plant and animal residue in the soil at various stages of decomposition.

In table 18, the estimated content of organic matter of the plow layer is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter of a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

soil and water features

Table 19 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary inundation of an area, is caused by overflowing streams or by runoff from adjacent slopes (fig. 15). Water standing for short periods after rainfall or snowmelt and water in swamps and marshes are not considered flooding.

Table 19 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, common, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *common* that it is likely under normal conditions; *occasional* that it occurs on an average of once or less in 2 years; and *frequent* that it occurs on an average of more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; November-May, for example, means that flooding can occur during the period November through May.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 19 are the depth to the seasonal high water table; the kind of water table—that is, perched, artesian, or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 19.

An apparent water table is a thick zone of free water

Figure 15.—Flooding along the St. Joseph River on Shoals silt loam, 0 to 2 percent slopes, is a hazard early in spring for people living on the flood plain.

in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. An artesian water table is under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole. A perched water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Subsidence is the settlement of organic soils or of saturated mineral soils of very low density. Subsidence results from either dessication and shrinkage or oxidation of organic material, or both, following drainage. Subsidence takes place gradually, usually over a period of several years. Table 19 shows the total subsidence, which usually is a result of oxidation.

Not shown in the table is subsidence caused by an imposed surface load or by the withdrawal of ground

water throughout an extensive area as a result of lowering the water table.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured clayey soils that have a high water table in winter are most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

classification of the soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*11*). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. In table 20, the soils of the survey area are classified according to the system. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Spodosol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Aquod (*Aqu*, meaning water, plus *od*, from Spodosol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Haplaquods (*Hapl*, meaning minimal horizonation, plus *aquods*, the suborder of the Spodosols that have an aquic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Entic* identifies the subgroup that is more recent than the typical great group. An example is Entic Haplaquods.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is sandy, mixed, mesic Entic Haplaquods.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

soil series and their morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the Soil Survey Manual (*9*). Many of the technical terms used in the descriptions are defined in Soil Taxonomy (*11*). Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed soil map units."

Abscota series

The Abscota series consists of moderately well drained soils on alluvial flood plains. These soils formed in sandy and loamy alluvium. Permeability is rapid. Slope ranges from 0 to 6 percent. These soils have a more calcareous subsoil and a darker surface layer than defined for the Abscota series, but this difference does not alter their usefulness or behavior.

Abscota soils are commonly adjacent to Cohoctah, Landes Variant, and Shoals soils. Cohoctah soils are poorly drained, have a mollic epipedon and are in shallow depressions and drainageways. Landes Variant

soils have a mollic epipedon. Shoals soils are somewhat poorly drained and are in shallow depressions and drainageways.

Typical pedon of Abscota sandy loam, 0 to 6 percent slopes, 1,000 feet west and 1,080 feet south of the NE corner of sec. 16, T. 5 S., R. 18 W.

Ap—0 to 10 inches; dark brown (10YR 3/3) sandy loam; brown (10YR 5/3) dry; moderate medium granular structure; friable; common fine roots; mildly alkaline; abrupt smooth boundary.

B21—10 to 17 inches; light gray (10YR 7/2) sand; common medium distinct very pale brown (10YR 7/4) and common fine distinct dark brown (10YR 3/3) mottles; single grain; loose; snail shells; few fine roots; 2 percent pebbles; strong effervescence; moderately alkaline; abrupt wavy boundary.

B22—17 to 39 inches; pale brown (10YR 6/3) sand; common medium faint light yellowish brown (10YR 6/4) and few fine distinct dark brown (10YR 3/3) mottles; single grain; loose; snail shells; 2 percent pebbles; strong effervescence; moderately alkaline; abrupt wavy boundary.

C1—39 to 41 inches; dark yellowish brown (10YR 4/4) sand; few fine distinct yellowish brown (10YR 5/6) mottles; single grain; loose; snail shells; 2 percent pebbles; strong effervescence; moderately alkaline; abrupt wavy boundary.

C2—41 to 47 inches; light yellowish brown (10YR 6/4) sand; few fine faint pale brown (10YR 6/3) mottles; single grain; loose; snail shells; 2 percent pebbles; strong effervescence; moderately alkaline; abrupt wavy boundary.

C3—47 to 50 inches; very dark brown (10YR 2/2) sand; common medium distinct light yellowish brown (10YR 6/4) mottles; single grain; loose; 2 percent pebbles; strong effervescence; moderately alkaline; abrupt wavy boundary.

C4—50 to 60 inches; pale brown (10YR 6/3) sand; common medium distinct yellowish brown (10YR 5/6) mottles; single grain; loose; strong effervescence; moderately alkaline.

Thickness of the solum ranges from 10 to 40 inches. Reaction ranges from slightly acid to moderately alkaline.

The Ap horizon has value of 3 or 4 and chroma of 1 to 3. It is dominantly sandy loam but includes loamy sand. The B2 horizon has value of 4 to 7 and chroma of 2 to 6. It is sand or loamy sand. The C horizon has value of 4 to 6 and chroma of 2 to 6. It is sand or coarse sand. Reaction is mildly alkaline or moderately alkaline.

Adrian series

The Adrian series consists of very poorly drained soils in depressions or old drainageways of lake plains and outwash plains. These soils formed in deposits of organic material 16 to 50 inches thick over sandy deposits. Permeability is moderately slow to moderately rapid in the organic material and rapid in the underlying layers. Slope ranges from 0 to 2 percent.

Adrian soils are similar to Edwards, Houghton, Kerston, and Palms soils and are commonly adjacent to them. Edwards soils have organic material underlain by marl. Houghton soils have deep layers of organic material. Kerston soils have alternating layers of organic and mineral material. Palms soils have organic material underlain by loamy material.

Typical pedon of Adrian muck, 1,900 feet east and 460 feet north of the SW corner of sec. 5, T. 6 S., R. 17 W.

Oa1—0 to 5 inches; very dark brown (10YR 2/2) broken face sapric material, dark reddish brown (5YR 2/2) rubbed; 10 percent fibers, less than 5 percent fibers rubbed; moderate medium granular structure; friable; many fine and medium roots; mainly herbaceous fibers; strongly acid; abrupt wavy boundary.

Oa2—5 to 18 inches; dark reddish brown (5YR 3/3) broken face sapric material, very dark gray (5YR 3/1) rubbed; 60 percent fibers, 10 percent fibers rubbed; strong coarse platy structure; friable; common fine roots; mainly herbaceous fibers; strongly acid; clear wavy boundary.

Oa3—18 to 26 inches; black (5YR 2/1) broken face and rubbed sapric material; 15 percent fibers, less than 5 percent fibers rubbed; massive; friable; few fine roots; mainly herbaceous fibers; strongly acid; abrupt smooth boundary.

IIC—26 to 39 inches; brown (10YR 5/3) loamy fine sand; single grain; very friable; strongly acid; clear wavy boundary.

IIC2—39 to 46 inches; dark brown (10YR 4/3) loamy fine sand; single grain; loose; strongly acid; clear wavy boundary.

IIC3—46 to 57 inches; pale brown (10YR 6/3) fine sand; common fine faint light brownish gray (10YR 6/2) mottles; single grain; loose; strongly acid; abrupt wavy boundary.

IIC4g—57 to 60 inches; gray (10YR 6/1) loamy fine sand; single grain; loose; strongly acid.

The organic layers are 16 to 50 inches deep over sand or gravelly sand. The organic material is mainly herbaceous. It is less than 5 percent rubbed fibers. Reaction ranges from strongly acid to moderately alkaline.

The surface layer is neutral or has hue of 10YR, value of 2 or 3, and chroma of 0 to 2. The subsurface organic layers have hue of 10YR, 7.5YR, or 5YR; value of 2 or 3; and chroma of 0 to 3. The IICg horizon is fine sand, loamy fine sand, loamy sand, or gravelly sand.

Belleville series

The Belleville series consists of poorly drained soils on lake plains and till plains. These soils formed in sandy

glaciofluvium overlying loamy lacustrine material or till. Permeability is rapid in the subsoil and moderately slow in the underlying material. Slope ranges from 0 to 2 percent.

Belleville soils are commonly adjacent to Blount, Rensselaer, Pewamo, Rimer, and Selfridge soils. Blount soils are somewhat poorly drained and are on slightly higher areas. Rensselaer soils do not have sandy layers in the solum. Pewamo soils have an argillic horizon. Rimer and Selfridge soils are somewhat poorly drained, have more clay in the B horizon, and are on higher ridges and knolls.

Typical pedon of Belleville loamy fine sand, 100 feet south and 2,610 feet west of the NE corner of sec. 28, T. 3 S., R. 18 W.

Ap—0 to 10 inches; very dark grayish brown (10YR 3/2) loamy fine sand; grayish brown (10YR 5/2) dry; moderate fine granular structure; very friable; many fine roots; neutral; abrupt smooth boundary.

B21g—10 to 18 inches; light brownish gray (10YR 6/2) sand; common medium distinct yellowish brown (10YR 5/6), and few fine faint grayish brown (10YR 5/2) mottles; single grain; loose; few fine roots; mildly alkaline; clear wavy boundary.

B22—18 to 24 inches; yellowish brown (10YR 5/8) loamy sand; common medium distinct grayish brown (10YR 5/2) mottles; very weak medium subangular blocky structure; loose; few fine roots; moderately alkaline; abrupt wavy boundary.

B23g—24 to 30 inches; grayish brown (10YR 5/2) sand; common fine distinct dark gray (10YR 4/1) mottles; single grain; loose; 5 percent pebbles; moderately alkaline; abrupt wavy boundary.

IICg—30 to 60 inches; gray (10YR 5/1) silty clay loam; few medium distinct olive (5Y 5/3) mottles; moderate thick platy structure; firm; less than 2 percent pebbles; strong effervescence; moderately alkaline.

Thickness of the solum and the depth to free carbonates is 20 to 40 inches. Thickness of the mollic epipedon is 10 to 13 inches.

The Ap horizon has value of 2 or 3 and chroma of 1 or 2. It ranges from slightly acid to mildly alkaline. The B2g horizon has value of 4 or 5 and chroma of 1 or 2. It is sand, loamy sand, or loamy fine sand. Reaction ranges from slightly acid to moderately alkaline. The B2 horizon is absent in some pedons. The IICg horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 or 2. It is silty clay loam, clay loam, or loam. It is mildly alkaline or moderately alkaline and has slight or strong effervescence.

Blount series

The Blount series consists of somewhat poorly drained soils on upland till plains. These soils formed in moderately fine textured or fine textured till. Permeability is slow or moderately slow. Slope ranges from 0 to 4 percent.

Blount soils are similar to Crosier and Glynwood soils and are commonly adjacent to Belleville, Crosier, Glynwood, Morley, and Pewamo soils. Belleville soils are poorly drained. They have 20 to 40 inches of sandy material over loamy material and are in shallow depressions and drainageways. Crosier soils are not as clayey as Blount soils. Glynwood soils are moderately well drained and are on slightly higher knolls and ridges. Morley soils are well drained and are on knolls and ridges. Pewamo soils are poorly drained and are in shallow depressions and drainageways.

Typical pedon of Blount loam, 0 to 4 percent slopes, 100 feet east and 1,160 feet north of the SW corner of sec. 28, T. 3 S., R. 18 W.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) loam, light brownish gray (10YR 6/2) dry; moderate medium granular structure; friable; many fine roots; less than 5 percent pebbles; medium acid; abrupt smooth boundary.

B1—9 to 11 inches; yellowish brown (10YR 5/6) clay loam; common medium distinct light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; firm; many fine roots; less than 5 percent pebbles; strongly acid; clear wavy boundary.

B21t—11 to 18 inches; yellowish brown (10YR 5/6) silty clay loam; common fine distinct gray (10YR 6/1) mottles; moderate medium subangular blocky structure; firm; continuous thin light gray (10YR 6/1) clay films on faces of peds; common fine roots; less than 5 percent pebbles; strongly acid; clear wavy boundary.

B22t—18 to 34 inches; dark yellowish brown (10YR 4/4) clay, faces of peds grayish brown (10YR 5/2); many medium distinct grayish brown (10YR 5/2) mottles; moderate medium angular blocky structure; firm; continuous thick grayish brown (10YR 5/2) clay films on faces of peds; few fine roots; less than 5 percent pebbles; neutral; abrupt wavy boundary.

C—34 to 60 inches; yellowish brown (10YR 5/4) clay loam; common fine distinct grayish brown (10YR 5/2) mottles; massive; firm; white (10YR 8/1) lime streaks; less than 5 percent pebbles; slight effervescence; mildly alkaline.

Thickness of the solum and the depth to free carbonates range from 23 to 42 inches. Coarse fragments range from 1 to 10 percent by volume.

The Ap horizon has chroma of 1 or 2. It is dominantly loam but includes silt loam. Reaction ranges from medium acid to mildly alkaline. The B1 horizon has value of 4 or 5 and chroma of 2 to 6. It is clay loam, sandy loam, silty clay loam, or loam. Reaction ranges from strongly acid to mildly alkaline. The B2t horizon has value of 4 to 6 and chroma of 2 to 4. It is clay loam, silty

clay loam, or clay and averages between 35 and 48 percent clay. Reaction ranges from strongly acid to mildly alkaline. The C horizon has value of 5 or 6 and chroma of 2 to 6. It is silty clay loam or clay loam. Reaction is mildly alkaline or moderately alkaline. Effervescence ranges from slight to strong.

Brady series

The Brady series consists of somewhat poorly drained soils on outwash plains, deltas, and lake plains. These soils formed in sandy and gravelly glaciofluvial deposits. Permeability is moderately rapid in the subsoil and very rapid in the underlying material. Slope ranges from 0 to 2 percent.

Brady soils are similar to Monitor soils and are commonly adjacent to Gilford, Monitor, Oshtemo, and Thetford soils. Gilford soils are very poorly drained and are in small depressions and drainageways. Monitor soils have a finer textured subsoil. Oshtemo soils are well drained; they are on higher areas and on the tops of knolls and ridges. Thetford soils are sandy and have a thinner, finer textured Bt horizon.

Typical pedon of Brady sandy loam, 0 to 2 percent slopes, 2,190 feet north and 2,376 feet east of the SW corner of sec. 14, T. 8 S., R. 20 W.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) sandy loam; grayish brown (10YR 5/2) dry; moderate medium granular structure; very friable; many fine roots; 5 percent pebbles; neutral; abrupt smooth boundary.

A2—9 to 11 inches; pale brown (10YR 6/3) loamy sand; common medium faint brown (10YR 5/3) and few fine distinct yellowish brown (10YR 5/6) mottles; weak fine granular structure; very friable; common fine roots; 5 percent pebbles; medium acid; clear wavy boundary.

B21t—11 to 24 inches; pale brown (10YR 6/3) sandy loam; common medium prominent strong brown (7.5YR 5/6) and common medium distinct grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; friable; few thin clay bridging between sand grains; few fine roots; 5 percent pebbles; strongly acid; gradual wavy boundary.

B22t—24 to 35 inches; strong brown (7.5YR 5/6) sandy loam; common coarse prominent grayish brown (10YR 5/2) and common faint prominent brown (10YR 5/3) mottles; moderate medium subangular blocky structure; friable; common thin clay bridging between sand grains; few fine roots; less than 5 percent pebbles; medium acid; abrupt wavy boundary.

B23g—35 to 48 inches; gray (10YR 5/1) stratified loam and loamy sand; common medium distinct yellowish brown (10YR 5/6) mottles; massive; friable; 10 percent pebbles; neutral; abrupt wavy boundary.

IIC1g—48 to 55 inches; grayish brown (10YR 5/2) sand; single grain; loose; 5 to 10 percent pebbles; slight effervescence; moderately alkaline; clear wavy boundary.

IIC2—55 to 60 inches; brown (10YR 5/3) sand; single grain; loose; 5 to 10 percent pebbles; slight effervescence; moderately alkaline.

Thickness of the solum ranges from 40 to 60 inches. Reaction ranges from strongly acid to neutral. Pebbles range from 1 to 25 percent by volume.

The Ap horizon has chroma of 1 or 2. It is dominantly sandy loam, but ranges to loamy sand. Some pedons have an A2 or B1 horizon. The B2t horizon has hue of 10YR and 7.5YR, value of 4 to 6, and chroma of 2 to 6. This horizon contains sandy clay loam layers less than 8 inches thick, but it is dominantly sandy loam. Some pedons have a B3 horizon. The IIC horizon has value of 5 or 6 and chroma of 1 to 3. It is sand or loamy sand and fine gravel.

Cohoctah series

The Cohoctah series consists of poorly drained soils in nearly level areas, in depressions on flood plains, and in shallow drainageways. These soils formed in loamy and sandy alluvial deposits. Permeability is moderately rapid. Slope ranges from 0 to 2 percent.

Cohoctah soils are commonly adjacent to Abscota, Houghton, Kerston, and Shoals soils. Abscota soils are moderately well drained and are on small ridges and in higher areas. Houghton soils have deep muck layers and are very poorly drained. Kerston soils are very poorly drained, with alternating layers of muck and mineral soil materials in slightly depressed oxbows. Shoals soils are somewhat poorly drained and are in slightly higher areas.

Typical pedon of Cohoctah sandy loam, 156 feet north and 2,320 feet west of the SE corner of sec. 10, T. 5 S., R. 19 W.

A1—0 to 5 inches; very dark grayish brown (10YR 3/2) sandy loam, grayish brown (10YR 5/2) dry; common medium faint very dark brown (10YR 2/2) and dark yellowish brown (10YR 3/4) mottles; moderate fine granular structure; friable; many fine roots; neutral; abrupt wavy boundary.

A12—5 to 15 inches; very dark gray (10YR 3/1) sandy loam; common fine faint grayish brown (10YR 5/2) and dark yellowish brown (10YR 3/4) mottles; moderate thick platy structure; friable; few fine roots; mildly alkaline; abrupt wavy boundary.

C1g—15 to 18 inches; grayish brown (10YR 5/2) loamy sand; common medium distinct dark yellowish brown (10YR 4/4) and very dark gray (10YR 3/1) mottles; weak fine granular structure; very friable; few fine roots; mildly alkaline; abrupt smooth boundary.

C2g—18 to 28 inches; dark gray (10YR 4/1) silt loam; many fine distinct dark reddish brown (5YR 3/4)

mottles; massive; friable; few fine roots; mildly alkaline; abrupt wavy boundary.

C3g—28 to 42 inches; very dark gray (5Y 3/1) fine sandy loam; common fine distinct grayish brown (10YR 5/2) mottles; massive; friable; neutral; clear wavy boundary.

C4g—42 to 48 inches; grayish brown (10YR 5/2) loamy sand; weak fine subangular blocky structure; very friable; very dark brown (10YR 2/2) organic stains; neutral; clear wavy boundary.

C5g—48 to 60 inches; grayish brown (10YR 5/2) fine sand; single grain; loose; neutral.

Reaction ranges from slightly acid to mildly alkaline in the upper 20 inches of the profile and from neutral to moderately alkaline below a depth of 20 inches. The A1 horizon has value of 2 or 3 and chroma of 1 or 2. It is dominantly sandy loam but ranges to fine sandy loam, loam, and loamy sand. The A2 horizon is absent in some pedons. The Cg horizon has hue of 10YR, 7.5YR, 5Y, and 2.5Y; value of 3 to 5; and chroma of 1 or 2. It is sandy loam, fine sandy loam, or loam with layers of loamy sand, fine sand, and silt loam.

Coupee series

The Coupee series consists of well drained soils on outwash plains. These soils formed in outwash that is loamy in the upper part and sandy in the lower part. Permeability is moderate in the solum and very rapid in the underlying material. Slope ranges from 0 to 3 percent.

Coupee soils are similar to Ockley soils and are commonly adjacent to Monitor, Ockley, and Oshtemo soils. All of these soils have less organic material in the surface layer. Also, Monitor soils are somewhat poorly drained and are in shallow depressions and drainageways.

Typical pedon of Coupee silt loam, 0 to 3 percent slopes, 300 feet south and 234 feet east of the NW corner of sec. 20, T. 8 S., R. 17 W.

Ap—0 to 10 inches; very dark brown (10YR 2/2) silt loam, dark brown (10YR 3/2) crushed; moderate medium granular structure; friable; common fine and medium roots; medium acid; clear smooth boundary.

A12—10 to 15 inches; very dark brown (10YR 2/2) silt loam; common fine faint dark brown (10YR 4/3) mottles; moderate medium granular structure; friable; common fine and medium roots; strongly acid; clear wavy boundary.

B21t—15 to 22 inches; dark brown (10YR 3/3) clay loam; moderate medium subangular blocky structure; friable; few thin dark brown (10YR 3/3) clay films on faces of peds; very dark grayish brown (10YR 3/2) root channels; few fine roots; strongly acid; clear wavy boundary.

B22t—22 to 29 inches; dark yellowish brown (10YR 4/4) sandy clay loam; moderate medium subangular blocky structure; friable; few thin brown (10YR 4/3) clay films on faces of peds; few fine roots; 2 percent pebbles; strongly acid; clear wavy boundary.

B3—29 to 35 inches; dark yellowish brown (10YR 4/4) sandy loam; weak medium granular structure; very friable; 10 percent pebbles and shale fragments; strongly acid; clear wavy boundary.

IIC1—35 to 55 inches; dark yellowish brown (10YR 4/4) sand; single grain; loose; 5 percent pebbles and shale fragments; strongly acid; abrupt wavy boundary.

IIC2—55 to 60 inches; dark yellowish brown (10YR 4/4) gravelly sand; single grain; loose; 45 percent pebbles and shale fragments; medium acid.

Thickness of the solum ranges from 40 to 60 inches. Depth to contrasting materials ranges from 30 to 40 inches. Reaction ranges from medium acid to very strongly acid. Thickness of the umbric epipedon ranges from 11 to 14 inches.

The Ap horizon has value of 2 or 3 and chroma of 1 or 2. It is dominantly silt loam but includes loam and sandy loam. The A12 horizon has value of 2 or 3 and chroma of 2 or 3. It is silt loam or sandy loam. Some pedons have a B1 horizon. The B2t horizon has hue of 10YR or 7.5YR, value of 3 to 5, and chroma of 3 or 4. It is clay loam, sandy clay loam, sandy loam, or loam. The IIC horizon has value of 4 to 6, and it is sand, coarse sand, or sand and gravel. Pebble and shale fragments range from 5 to 50 percent by volume.

Crosier series

The Crosier series consists of somewhat poorly drained soils on till plains and moraines. These soils formed in loamy till. Permeability is moderately slow. Slope ranges from 0 to 4 percent. These soils have a thicker, more acid solum and a siltier subsoil than defined for the Crosier series, but these differences do not alter their usefulness or behavior.

Crosier soils are similar to Blount soils and are commonly adjacent to Kibbie, Monitor, Pewamo, Rensselaer, and Selfridge soils. Blount soils have a more clayey B horizon. Monitor soils have sandy textured underlying material. Pewamo soils are poorly drained and have a more clayey B horizon. Rensselaer soils are very poorly drained and are in depressions and natural drainageways. Selfridge soils have 20 to 40 inches of sandy material over loamy material.

Typical pedon of Crosier silt loam, 0 to 4 percent slopes, 105 feet west and 2,254 feet south of the NE corner of sec. 17, T. 6 S., R. 18 W.

Ap—0 to 9 inches; brown (10YR 4/3) silt loam; moderate medium granular structure; friable; many fine roots; 5 percent pebbles; medium acid; abrupt smooth boundary.

B21tg—9 to 17 inches; light brownish gray (10YR 6/2) silt loam; common medium prominent yellowish

brown (10YR 5/6) mottles; moderate medium subangular blocky structure; friable; common thin grayish brown (10YR 5/2) clay films on faces of peds; dark grayish brown (10YR 4/2) worm casts; many fine roots; 5 percent pebbles; strongly acid; clear wavy boundary.

B22t—17 to 37 inches; yellowish brown (10YR 5/4) silty clay loam; common fine distinct light grayish brown (10YR 6/2) and common medium faint dark yellowish brown (10YR 4/4) mottles; moderate medium subangular blocky structure; firm; common moderately thick light grayish brown (10YR 6/2) clay films on faces of peds; dark grayish brown (10YR 4/2) worm casts; few fine roots; 5 percent pebbles; medium acid; gradual wavy boundary.

B23t—37 to 46 inches; brownish yellow (10YR 6/6) silt loam; common medium distinct light brownish gray (10YR 6/2) and yellowish brown (10YR 5/4) mottles; small irregular dark reddish brown (5YR 2/2) Fe-Mn concretions; moderate medium subangular blocky structure; friable; few thin grayish brown (10YR 5/2) clay films on faces of peds; few fine roots; 3 percent pebbles; medium acid; gradual wavy boundary.

C—46 to 60 inches; light yellowish brown (10YR 6/4) silt loam; common fine distinct light brownish gray (10YR 6/2) and brownish yellow (10YR 6/6) mottles; massive; friable; 2 percent pebbles; medium acid.

Thickness of the solum ranges from 40 to 50 inches. Reaction ranges from strongly acid to neutral. Coarse fragments range from 1 to 10 percent by volume.

The Ap horizon has value of 3 to 5 and chroma of 2 or 3. Thickness of the surface horizon ranges from 8 to 11 inches. It is dominantly silt loam but includes sandy loam and loam. The B2t horizon has value of 4 to 6 and chroma of 2 to 6. It is silt loam, silty clay loam, clay loam, and loam. The C horizon has value of 5 or 6 and chroma of 3 or 4. It is loam, clay loam, sandy loam, or silt loam. Reaction ranges from medium acid to moderately alkaline.

Edwards series

The Edwards series consists of very poorly drained soils in depressions on outwash plains, lake plains, till plains, and moraines. These soils formed in muck overlying marl deposits. Permeability is moderately slow to moderately rapid in the organic material and variable in the underlying layers. Slope ranges from 0 to 2 percent.

Edwards soils are similar to Adrian, Houghton, and Palms soils, and are commonly adjacent to Adrian, Houghton, Palms, and Pella soils. Adrian soils have sandy underlying material. Houghton soils do not have marl below the muck. Palms soils are underlain by loam. Pella soils are mineral soils.

Typical pedon of Edwards muck, 2,440 feet south and 380 feet east of the NW corner of sec. 34, T. 3 S., R. 17 W.

Oa1—0 to 10 inches; dark reddish brown (5YR 2/2) broken face sapric material, and black (5YR 2/1) rubbed; less than 5 percent fibers; weak fine granular structure; friable; many fine roots; mainly herbaceous fibers; neutral; gradual wavy boundary.

Oa2—10 to 22 inches; dark reddish brown (5YR 2/2) broken face sapric material, black (5YR 2/1) rubbed; about 20 percent fibers, less than 5 percent fibers rubbed; moderate medium subangular blocky structure; friable; many fine roots; mainly herbaceous fibers; neutral; abrupt smooth boundary.

Lcal—22 to 55 inches; light gray (10YR 6/1) marl; massive; very friable; few fine roots; strong effervescence; moderately alkaline; gradual wavy boundary.

Lca2—55 to 60 inches; light gray (10YR 6/1) marl; common medium distinct brown (7.5YR 5/2) mottles; massive; very friable; strong effervescence; moderately alkaline.

Depth to the Lca horizon ranges from 16 to 48 inches. Reaction above the Lca horizon ranges from slightly acid to mildly alkaline.

The Oa horizon has hue of 10YR, 7.5YR, or 5YR; value of 2 or 3; and chroma of 1 to 3. It is dominantly sapric material with thin layers of hemic or fibric material. A few wood fragments are in some pedons. The Lca horizon has value of 5 or 6. It is mildly alkaline to moderately alkaline.

Elvers series

The Elvers series consists of poorly drained or very poorly drained soils on muck areas adjacent to upland mineral soils. Elvers soils formed in alluvial, mineral soil deposits over organic material. Permeability is moderate in the mineral material and moderately slow to moderately rapid in the organic underlying layers. Slope is 0 to 2 percent.

Elvers soils are adjacent to Houghton, Kerston, and Pewamo soils. Houghton soils have mucky material to a depth of 51 inches. Kerston soils have a mucky surface layer and contain alternating strata of muck and mineral material. Pewamo soils are poorly drained and have an illuvial, mineral subsoil.

Typical pedon of Elvers silt loam, 3 feet west and 690 feet south of the NE corner of sec. 25, T. 6 S., R. 19 W.

Ap—0 to 6 inches; dark brown (10YR 4/3) silt loam; few fine faint dark grayish brown (10YR 4/2) mottles; moderate medium granular structure; friable; common fine roots; mildly alkaline; abrupt smooth boundary.

C1—6 to 13 inches; brown (10YR 5/3) silt loam; common medium distinct grayish brown (10YR 5/2)

mottles; moderate medium subangular blocky structure; friable; common fine roots; mildly alkaline; gradual wavy boundary.

C2g—13 to 23 inches; grayish brown (10YR 5/2) silt loam; many medium distinct yellowish brown (10YR 5/4) mottles; moderate medium subangular blocky structure; friable; few fine roots; mildly alkaline; abrupt smooth boundary.

IIOa1—23 to 36 inches; black (5Y 2/1) broken face and rubbed sapric material; about 5 percent fibers, less than 5 percent fibers rubbed; moderate coarse platy structure; friable; about 5 percent mineral material; few fine roots; mainly herbaceous fibers; mildly alkaline; clear wavy boundary.

IIOa2—36 to 60 inches; dark reddish brown (5YR 2/2) broken face sapric material; very dark gray (5YR 3/1) rubbed; strong coarse platy structure; friable; mainly herbaceous fibers; neutral.

Thickness of the mineral soil ranges from 16 to 40 inches. Thickness of the underlying organic layer is 20 inches or more. Reaction ranges from medium acid to mildly alkaline.

The Ap and A1 horizons have hue of 10YR or 2.5Y, value of 2 to 4, and chroma of 0 to 3. The B horizon has hue of 10YR or 2.5Y, value of 3 to 5, and chroma of 1 to 4. The IIOa horizon has hue of 10YR or 5YR, value of 2 or 3, chroma of 0 to 2. It is hemic or sapric material.

Gilford series

The Gilford series consists of very poorly drained soils on outwash plains and lake plains. These soils formed in loamy and sandy glaciofluvial deposits. Permeability is moderately rapid in the subsoil and rapid in the underlying material. Slope ranges from 0 to 2 percent.

Gilford soils are similar to Sebewa soils, and are commonly adjacent to Brady, Granby, Monitor, and Sebewa soils. Brady soils are somewhat poorly drained and are on slightly higher ridges and rises. Granby soils have more sand in the subsoil. Sebewa soils have a finer textured subsoil.

Typical pedon of Gilford sandy loam, 123 feet south and 2,199 feet east of the NW corner of sec. 23, T. 6 S., R. 19 W.

Ap—0 to 11 inches; very dark gray (10YR 3/1) sandy loam, gray (10YR 5/1) dry; moderate medium subangular blocky structure; friable; common fine roots; medium acid; abrupt smooth boundary.

B21g—11 to 18 inches; dark gray (10YR 4/1) fine sandy loam; common fine distinct very dark gray (10YR 3/1) and dark yellowish brown (10YR 4/4) mottles; moderate medium subangular blocky structure; friable; few fine roots; medium acid; gradual wavy boundary.

B22g—18 to 33 inches; dark gray (10YR 4/1) sandy loam with silty clay loam chunks; common medium distinct strong brown (7.5YR 5/8) and grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; friable; few fine roots; medium acid; clear wavy boundary.

B3g—33 to 38 inches; grayish brown (10YR 5/2) loamy sand; very fine subangular blocky structure; very friable; medium acid; abrupt wavy boundary.

IIC1g—38 to 50 inches; light brownish gray (10YR 6/2) sand; common fine faint yellowish brown (10YR 5/8) mottles; single grain; loose; medium acid; diffuse wavy boundary.

IIC2g—50 to 60 inches; light brownish gray (10YR 6/2) sand; common fine faint yellowish brown (10YR 5/8) mottles; single grain; loose; neutral.

Thickness of the solum ranges from 22 to 40 inches. Reaction ranges from medium acid to neutral. Thickness of the mollic epipedon ranges from 10 to 12 inches.

The A horizon has value of 2 or 3 and chroma of 1 to 3. It is dominantly sandy loam but includes loam and loamy sand. Some pedons have an A2 or A12 horizon. The B2g horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 or 2. It is sandy loam, loamy sand, and sandy clay loam. The B3g horizon has value of 4 or 5 and chroma of 1 or 2. It is sandy loam or loamy sand. The IICg horizon has hue of 10YR or 5Y, value of 5 or 6, and chroma of 1 or 2. It includes sand, coarse sand, and fine sand. Some pedons have strata of silt loam, sandy loam, and clay loam. Reaction of the IICg horizon ranges from medium acid to mildly alkaline.

Glynwood series

The Glynwood series consists of moderately well drained, soils on moraines and till plains. These soils formed dominantly in loamy and clayey calcareous till. Permeability is slow. Slope ranges from 6 to 12 percent. These soils have a grayer subsoil than defined for the Glynwood series, but this difference does not alter their usefulness or behavior.

Glynwood soils are similar to Blount soils and are commonly adjacent to Blount, Morley, Pewamo, and Rimer soils. Blount soils are somewhat poorly drained and are in small depressions and natural drainageways. Morley soils are well drained and are on slightly higher rises or tops of knolls. Pewamo soils are poorly drained and are in depressions and drainageways. Rimer soils are somewhat poorly drained; they are in slight depressions and have 20 to 40 inches of loamy sand over fine textured soil material.

Typical pedon of Glynwood loam, 6 to 12 percent slopes, 690 feet west and 2,529 feet south of the NE corner of sec. 14, T. 3 S., R. 18 W.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) loam, light brownish gray (10YR 6/2) dry; moderate medium granular structure; friable; many fine roots; 2 percent pebbles; slightly acid; abrupt smooth boundary.

B21t—7 to 14 inches; yellowish brown (10YR 5/6) silty clay loam; common medium distinct light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; firm; few thin light brownish gray (10YR 6/2) clay films on faces of peds; common fine roots; 2 percent pebbles; neutral; clear wavy boundary.

B22t—14 to 26 inches; yellowish brown (10YR 5/6) clay; few fine distinct grayish brown (10YR 5/2) mottles; few fine dark reddish brown (5YR 2/2) accumulations (Fe and Mn oxides); moderate medium prismatic structure parting to moderate medium angular blocky; firm; few thin grayish brown (10YR 5/2) clay films on faces of peds; few fine roots; 2 percent pebbles; slightly acid; abrupt wavy boundary.

C1—26 to 40 inches; yellowish brown (10YR 5/4) silty clay loam; few medium faint (10YR 5/3) mottles; moderate medium prismatic structure parting to strong coarse angular blocky; firm; few fine roots; 2 percent pebbles; slight effervescence; mildly alkaline; clear wavy boundary.

C2—40 to 60 inches; light yellowish brown (10YR 6/4) silty clay loam; few medium faint yellowish brown (10YR 5/4) mottles; massive; firm; light gray (10YR 7/2) lime streaks; 2 percent pebbles; slight effervescence; mildly alkaline.

Thickness of the solum and depth to free carbonates range from 22 to 33 inches. Reaction in the solum ranges from medium acid to mildly alkaline. Coarse fragments range from 1 to 10 percent by volume.

The Ap horizon has value of 4 or 5 and chroma of 2 or 3. Thickness of the surface horizon ranges from 7 to 10 inches. Some pedons have an A2 or B1 horizon. The B2t horizon has value of 4 or 5 and chroma of 2 to 6. It is silty clay loam, clay loam, or clay. The C horizon has value of 4 to 6 and chroma of 3 to 6. It has light gray (10YR 7/1 and 7/2) lime streaks. It is silty clay loam or clay loam.

Granby series

The Granby series consists of poorly drained soils on outwash plains and lake plains. These soils formed in sandy outwash or lacustrine materials. Permeability is rapid. Slope ranges from 0 to 2 percent.

Granby soils are commonly adjacent to Belleville, Gilford, Morocco, Oakville, and Pipestone soils. Belleville soils have loamy underlying material at a depth of 20 to 40 inches. Gilford soils are not as sandy as Granby soils in the subsoil. Morocco soils are somewhat poorly drained and are on higher plains and knolls. Oakville soils are well drained and are on higher knolls and ridges. Pipestone soils are somewhat poorly drained and are on slightly higher rises and ridges.

Typical pedon of Granby loamy fine sand, 60 feet south and 140 feet east of the NW corner of sec. 3, T. 7 S., R. 19 W.

Ap—0 to 12 inches; very dark brown (10YR 2/2) loamy fine sand, dark gray (10YR 4/1) dry; moderate medium granular structure; friable; many fine roots; neutral; abrupt smooth boundary.

B21g—12 to 30 inches; grayish brown (10YR 5/2) fine sand; common fine distinct yellowish brown (10YR 5/6) and gray (10YR 5/1) mottles; weak fine granular structure; very friable few fine roots; mildly alkaline; clear wavy boundary.

B22g—30 to 46 inches; light brownish gray (10YR 6/2) fine sand; many medium prominent yellowish brown (10YR 5/6) mottles; single grain; loose; slight effervescence; mildly alkaline; clear wavy boundary.

Cg—46 to 60 inches; grayish brown (10YR 5/2) fine sand; many medium distinct yellowish brown (10YR 5/6) mottles; single grain; loose; slight effervescence; mildly alkaline.

Thickness of the solum ranges from 24 to 49 inches. Thickness of the mollic epipedon ranges from 11 to 14 inches.

The Ap horizon has value of 2 or 3 and chroma of 1 or 2. It is dominantly loamy fine sand but includes loamy sand or sand. Reaction ranges from medium acid to neutral. The Bg horizon has hue of 10YR and 2.5Y, value of 4 to 6, and chroma of 1 or 2. It is fine sand, loamy sand, or loamy fine sand. Reaction ranges from medium acid to mildly alkaline. The Cg horizon has hue of 10YR, 2.5Y, or 5YR; value of 5 or 6; and chroma of 1 to 3. It is fine sand or sand, and reaction is neutral or mildly alkaline.

Houghton series

The Houghton series consists of very poorly drained soils in depressions on lake plains, outwash plains, till plains, flood plains, and moraines. These soils formed in herbaceous organic deposits. Permeability is moderately slow to moderately rapid. Slope ranges from 0 to 2 percent.

Houghton soils are similar to Adrian, Edwards, Kerston, Palms, and Elvers soils and are commonly adjacent to them. Adrian soils are muck soils that have sandy underlying material. Edwards soils are muck soils that have marl underlying material. Kerston soils have alternating layers of organic and mineral materials. Palms soils are muck soils that have loamy underlying material. Elvers soils have silt loam overlying muck.

Typical pedon of Houghton muck, 75 feet west and 690 feet south of the NE corner of sec. 30, T. 6 S., R. 18 W.

Oa1—0 to 8 inches; dark reddish brown (5YR 2/2) broken face and rubbed sapric material; less than 5 percent fibers broken face and rubbed; moderate medium granular structure; friable; many fine and medium roots; mainly herbaceous fibers; neutral; abrupt smooth boundary.

Oa2—8 to 12 inches; dark reddish brown (5YR 3/2) broken face sapric material, dark reddish brown (5YR 2/2) rubbed; about 20 percent fibers, less than 5 percent fibers rubbed; strong coarse blocky structure; friable; many fine and medium roots; mainly herbaceous fibers; neutral; abrupt wavy boundary.

Oa3—12 to 24 inches; black (5YR 2/1) broken face and rubbed sapric material; about 10 percent fibers, less than 5 percent fibers rubbed; moderate medium subangular blocky structure; friable; common fine roots; mainly herbaceous fibers; mildly alkaline; abrupt wavy boundary.

Oa4—24 to 31 inches; dark reddish brown (5YR 3/3) broken face sapric material, dark reddish brown (5YR 2/2) rubbed; about 20 percent fibers, 10 percent fibers rubbed; massive; friable; few fine roots; mainly herbaceous fibers; mildly alkaline; clear wavy boundary.

Oa5—31 to 49 inches; black (5YR 2/1) broken face and rubbed sapric material; about 20 percent fibers, 5 percent fibers rubbed; massive; friable; few fine roots; mainly herbaceous fibers; mildly alkaline; abrupt wavy boundary.

Oa6—49 to 60 inches; dark reddish brown (5YR 3/3) broken faced sapric material, dark reddish brown (5YR 2/2) rubbed; about 50 percent fibers, 10 percent fibers rubbed; massive; friable; mainly herbaceous fibers; mildly alkaline.

Thickness of the organic layer is more than 51 inches. The organic material is mainly herbaceous. Reaction ranges from mildly alkaline to strongly acid.

The surface layer has hue of 10YR to 5YR, value of 2 or 3, and chroma of 1 or 2. The subsurface layer has hue of 10YR, 7.5YR, or 5YR; value of 2 or 3; and chroma of 1 to 3. The hemic material is less than 10 inches thick, and the fibric material is less than 5 inches thick. Some pedons have woody fragments that range from about 1 inch to 8 inches in diameter.

Kerston series

The Kerston series consists of very poorly drained soils on flood plains. These soils formed in alternating layers of muck and mineral material. Permeability is moderately rapid to rapid in the organic material and rapid in the underlying layers. Slope ranges from 0 to 2 percent.

Kerston soils are similar to Adrian and Palms soils and are commonly adjacent to Adrian, Cohoctah, Houghton, Palms, and Elvers soils. Adrian soils do not have alternating strata of muck and mineral material and are underlain by sand. Cohoctah soils are mineral and do not have thick strata of mucky material in the profile. Houghton soils do not have mineral material to a depth of 51 inches. Palms muck does not have stratification of muck and mineral materials and are underlain by loams. Elvers soils have silt loam over muck.

Typical pedon of Kerston muck in an area of Houghton-Kerston mucks, 1,164 feet east and 854 feet north of the SW corner of sec. 31, T. 4 S., R. 18 W.

Oa1—0 to 6 inches; black (5YR 2/1) broken face and rubbed sapric material; less than 5 percent fibers; moderate medium granular structure; friable; about 30 percent mineral content; many fine roots; mainly herbaceous fibers; mildly alkaline; abrupt smooth boundary.

Oa2—6 to 21 inches; black (5YR 2/1) broken face and rubbed sapric material; less than 5 percent fibers; moderate medium subangular blocky structure; friable; many fine roots; herbaceous fibers; mildly alkaline; abrupt smooth boundary.

IIC1g—21 to 23 inches; dark gray (10YR 4/1) silt loam; massive; friable; common fine roots; mildly alkaline; abrupt smooth boundary.

IIOa3—23 to 26 inches; very dark grayish brown (10YR 3/2) broken face and rubbed sapric material; massive; friable; about 20 percent mineral content; common fine roots; mainly herbaceous fibers; mildly alkaline; abrupt smooth boundary.

IIC2g—26 to 33 inches; light brownish gray (10YR 6/2) and dark grayish brown (10YR 4/2) fine sand; single grain; loose; few fine roots; mildly alkaline; clear wavy boundary.

IIC3g—33 to 40 inches; dark gray (10YR 4/1) sandy loam; massive; friable; mildly alkaline; abrupt smooth boundary.

IIC4g—40 to 46 inches; very dark gray (10YR 3/1) silt loam; massive; very friable; neutral; abrupt smooth boundary.

IIC5g—46 to 60 inches; gray (10YR 5/1) sand; single grain; loose; strong effervescence; moderately alkaline.

Depth to the IIC horizon ranges from 16 to 40 inches. This horizon is typically well decomposed sapric material derived from herbaceous material, but it can contain woody fragments. Reaction ranges from medium acid to moderately alkaline.

The Oa horizon is neutral or has hue of 10YR or 5YR; value of 2 or 3; and chroma of 0 to 2. The IIC horizon has value of 4 or 5 and chroma of 1 or 2. It is sand, fine sand, loamy fine sand, fine sandy loam, sandy loam, and silt loam.

Kibbie series

The Kibbie series consists of somewhat poorly drained soils on lake plains, deltas, and outwash plains. They formed in stratified loamy and sandy materials. Permeability is moderate. Slope ranges from 0 to 3 percent. These soils contain more silt and less sand than defined for Kibbie soils, but this does not alter their behavior or usefulness.

Kibbie soils are similar to Whitaker soils and are commonly adjacent to Crosier, Lenawee, Martinsville,

and Pella soils. Whitaker soils do not have a mollic epipedon. Crosier soils do not have a mollic epipedon and are not stratified. Lenawee soils are poorly drained, have a fine textured subsoil, and are in the shallow depressions and drainageways. Martinsville soils are well drained and are on higher knolls and ridges. Pella soils are poorly drained and are in shallow depressions and drainageways.

Typical pedon of Kibbie loam, 0 to 3 percent slopes, 2,600 feet south and 210 feet west of the NE corner of sec. 34, T. 3 S., R. 17 W.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) loam; grayish brown (10YR 5/2) dry; moderate medium granular structure; friable; many fine roots; 5 percent pebbles; neutral; abrupt smooth boundary.

B21t—9 to 19 inches; yellowish brown (10YR 5/4) silt loam; few fine distinct grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; friable; few thin grayish brown (10YR 5/2) clay films on faces of peds; grayish brown (10YR 5/2) worm casts; common fine roots; mildly alkaline; clear wavy boundary.

B22t—19 to 32 inches; yellowish brown (10YR 5/6) silty clay loam; common medium distinct gray (10YR 6/1) and grayish brown (10YR 5/2) mottles; moderate medium angular blocky structure; firm; many thin brown (7.5YR 5/2) clay films on faces of peds; dark grayish brown (10YR 4/2) worm casts; common fine roots; neutral; abrupt smooth boundary.

C1—32 to 49 inches; light yellowish brown (10YR 6/4) stratified silt, silt loam, and silty clay loam; common fine distinct light brownish gray (10YR 6/2) and brownish yellow (10YR 6/6) mottles; moderate medium platy structure; very friable; light gray (10YR 7/2) lime streaks; slight effervescence; mildly alkaline; gradual wavy boundary.

C2—49 to 60 inches; yellowish brown (10YR 5/6) stratified silt and very fine sand; common medium distinct light brownish gray (10YR 6/2) mottles; massive; very friable; slight effervescence; mildly alkaline.

Thickness of the solum and depth to free carbonates range from 26 to 48 inches.

The Ap horizon has value of 2 or 3 and chroma of 1 or 2. It is dominantly loam but includes sandy loam, silt loam, or fine sandy loam. Reaction ranges from medium acid to neutral. The B2t horizon has value of 4 to 6 and chroma of 3 to 6. It is clay loam, silt loam, or silty clay loam. Reaction is slightly acid or neutral. The C horizon has hue of 10YR, 7.5YR, or 2.5Y; value of 5 or 6; and chroma of 2 to 4. It contains strata of silty clay loam, very fine sand, silt, clay, very fine sandy loam, and loamy very fine sand. Reaction is mildly alkaline or moderately alkaline. Effervescence ranges from slight to strong.

Landes Variant

The Landes Variant consists of well drained and moderately well drained soils on flood plains of major creeks and rivers. Permeability is moderately rapid or rapid. Slope ranges from 0 to 3 percent.

Landes Variant soils are commonly adjacent to Abscota, Cohoctah, and Shoals soils. Abscota soils are sandier and do not have a mollic epipedon. Cohoctah soils are poorly drained and are in shallow depressions and drainageways. Shoals soils are somewhat poorly drained and are in shallow depressions and drainageways.

Typical pedon of Landes Variant silt loam, 0 to 3 percent slopes, 209 feet north and 330 feet west of the SE corner of sec. 34, T. 5 S., R. 18 W.

Ap—0 to 10 inches; very dark grayish brown (10YR 3/2) silt loam, brown (10YR 5/3) dry; moderate medium granular structure; friable; many fine roots; slight effervescence; moderately alkaline; abrupt smooth boundary.

B1—10 to 16 inches; dark brown (10YR 4/3) very fine sandy loam; moderate medium subangular blocky structure; friable; very dark grayish brown (10YR 3/2) root channels and worm casts; many fine roots; slight effervescence; moderately alkaline; clear wavy boundary.

B2—16 to 40 inches; dark yellowish brown (10YR 4/4) very fine sandy loam; few fine distinct pale brown (10YR 6/3) mottles; moderate medium subangular blocky structure; friable; few fine roots; slight effervescence; moderately alkaline; gradual wavy boundary.

C—40 to 60 inches; pale brown (10YR 6/3) silt loam; common medium distinct strong brown (7.5YR 5/6) mottles; massive; friable; slight effervescence; moderately alkaline.

Thickness of the solum ranges from 25 to 40 inches. Reaction is mildly alkaline or moderately alkaline.

The Ap horizon has hue of 10YR or 7.5YR, value of 2 or 3, and chroma of 2 or 3. It is dominantly silt loam but includes loam, fine sandy loam, or sandy loam. The B and C horizons have hue of 10YR and 7.5YR, value of 4 to 6, and chroma of 3 to 6. They are silt loam, loam, very fine sandy loam, and fine sandy loam.

Lenawee series

The Lenawee series consists of poorly drained soils on lake plains. These soils formed in calcareous loamy and clayey lacustrine deposits. Permeability is moderately slow. Slope ranges from 0 to 2 percent.

Lenawee soils are similar to Pella soils and are commonly adjacent to Blount, Kibbie, Pella, and Pewamo soils. Pella soils have a mollic epipedon and are more silty. Blount soils are somewhat poorly drained, do not

have stratification, and are on higher knolls and ridges. Kibbie soils are somewhat poorly drained and are on higher knolls and ridges. Pewamo soils have a mollic epipedon and do not have stratification.

Typical pedon of Lenawee silty clay loam, 123 feet south and 620 feet west of the NE corner of sec. 6, T. 8 S., R. 19 W.

Ap—0 to 8 inches; very dark brown (10YR 2/2) silty clay loam, grayish brown (10YR 5/2) dry; strong medium granular structure; firm; common fine roots; neutral; abrupt smooth boundary.

B21g—8 to 11 inches; gray (10YR 5/1) clay; common medium prominent dark brown (7.5YR 4/4) mottles; strong medium angular blocky structure; firm; very dark gray (10YR 3/1) root channels; few fine roots; mildly alkaline; clear wavy boundary.

B22g—11 to 26 inches; gray (10YR 5/1) silty clay; common medium distinct yellowish brown (10YR 5/6) mottles; strong medium platy structure breaking to strong medium angular blocky; firm; few fine roots; mildly alkaline; abrupt wavy boundary.

C1g—26 to 50 inches; olive gray (5Y 5/2) silty clay loam; common medium prominent yellowish brown (10YR 5/6) mottles; massive; firm; slight effervescence; mildly alkaline; clear wavy boundary.

C2g—50 to 60 inches; grayish brown (10YR 5/2) stratified silty clay, silt, and silt loam; common medium distinct yellowish brown (10YR 5/6) mottles; massive; friable; slight effervescence; mildly alkaline.

Thickness of the solum and depth to free carbonates range from 25 to 50 inches. Reaction in the solum ranges from medium acid to mildly alkaline.

The Ap horizon has value of 2 or 3 and chroma of 1 or 2. It is dominantly silty clay loam, but the range includes silt loam and loam. The B2g horizon has hue of 10YR, 7.5YR, or 2.5Y; value of 4 to 6; and chroma of 1 or 2. It is clay, silty clay, or silty clay loam. The Cg horizon has hue of 10YR, 2.5Y, and 5Y; value of 5 or 6; and chroma of 1 to 6. It is stratified silty clay loam, silty clay, silt loam, and silt.

Martinsville series

The Martinsville series consists of well drained soils on terraces, lake plains, and outwash plains. These soils formed in stratified loamy material. Permeability is moderate. Slope ranges from 2 to 12 percent.

Martinsville soils are similar to Kibbie and Ockley soils and are commonly adjacent to Kibbie, Ockley, Riddles, and Whitaker soils. Kibbie soils are somewhat poorly drained, have a mollic epipedon, and are in shallow depressions and drainageways. Ockley and Riddles soils do not have stratification of silts and fine sands. Whitaker soils are somewhat poorly drained and are in lower depressions and drainageways.

Typical pedon of Martinsville fine sandy loam, 2 to 6 percent slopes, 339 feet north and 105 feet east of the SW corner of sec. 24, T. 3 S., R. 18 W.

Ap—0 to 7 inches; brown (10YR 4/3) fine sandy loam; moderate medium granular structure; very friable; common fine roots; medium acid; abrupt smooth boundary.

B21t—7 to 26 inches; brown (7.5YR 4/4) silty clay loam; strong coarse subangular blocky structure; friable; few thin clay bridgings between sand grains; few fine roots; strongly acid; gradual wavy boundary.

B22t—26 to 32 inches; brown (7.5YR 4/4) clay loam; strong medium subangular blocky structure; friable; few thin dark brown (7.5YR 4/4) clay films on faces of peds; few fine roots; strongly acid, abrupt wavy boundary.

B23t—32 to 38 inches; brown (7.5YR 5/4) fine sandy loam; common medium faint strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; friable; few thin clay bridgings between sand grains; few fine roots; strongly acid; abrupt wavy boundary.

IIC1—38 to 42 inches; light yellowish brown (10YR 6/4) fine sand; single grain; loose; strongly acid; abrupt wavy boundary.

IIC2—42 to 60 inches; pale brown (10YR 6/3) sand; single grain; loose; and strong brown (7.5YR 5/6) loamy sand; weak fine subangular blocky structure; very friable; medium acid.

Thickness of the solum ranges from 36 to 50 inches. Coarse fragments range from 0 to 10 percent by volume. Reaction ranges from strongly acid to slightly acid.

The Ap horizon has value of 3 to 5 and chroma of 2 to 4. It is dominantly fine sandy loam, but the range includes loam, silt loam, and sandy loam. Some pedons have a B1 horizon. The B2t horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 3 to 6. It is clay loam, silty clay loam, sandy clay loam, loam, or sandy loam. Some pedons have a B3 horizon. The IIC horizon has value of 4 to 6 and chroma of 3 to 6. It is stratified sand, fine sand, silt, silt loam, or loam. Reaction ranges from strongly acid to moderately alkaline.

Metea series

The Metea series consists of well drained soils on moraines and till plains. These soils formed in sandy and loamy material. Permeability is very rapid in the subsoil and moderate or moderately slow in the underlying material. Slope ranges from 1 to 12 percent.

Metea soils are similar to Tustin soils and are commonly adjacent to Riddles, Selfridge, and Spinks soils. Tustin soils have more clayey underlying material. Riddles soils do not have 20 inches of sandy material. Selfridge soils are somewhat poorly drained and are in shallow depressions and drainageways. Spinks soils do not have the loamy underlying material.

Typical pedon of Metea loamy sand, 1 to 6 percent slopes, 127 feet north and 939 feet east of the SW corner of sec. 33, T. 3 S., R. 17 W.

Ap—0 to 8 inches; dark brown (10YR 3/3) loamy sand; brown (10YR 5/3) dry; weak fine granular structure; very friable; 5 percent pebbles; medium acid; abrupt smooth boundary.

A21—8 to 18 inches; yellowish brown (10YR 5/6) loamy sand; weak medium subangular blocky structure; very friable; 4 percent pebbles; medium acid; gradual wavy boundary.

A22—18 to 34 inches; yellowish brown (10YR 5/6) sand; common fine faint pale brown (10YR 6/3) mottles; single grain; loose; 4 percent pebbles; slightly acid; abrupt wavy boundary.

B21t—34 to 36 inches; dark brown (7.5YR 4/4) sandy loam; strong fine subangular blocky structure; friable; few fine roots; 5 percent pebbles; neutral; abrupt wavy boundary.

IIB22t—36 to 41 inches; yellowish brown (10YR 5/4) clay loam, few medium distinct grayish brown (10YR 5/2) and common medium faint dark yellowish brown (10YR 4/4) mottles; moderate medium subangular blocky structure; firm; many moderately thick yellowish brown (10YR 5/4) clay films on faces of peds; few fine roots; 5 percent pebbles and cobbles; neutral; abrupt wavy boundary.

IIC—41 to 60 inches; yellowish brown (10YR 5/4) clay loam; common medium distinct grayish brown (10YR 5/2) mottles; massive; few thin lime streaks; 5 to 10 percent pebbles and cobbles; slight effervescence; mildly alkaline.

Thickness of the solum and depth to free carbonates range from 36 to 50 inches. Thickness of the loamy sand or sand upper horizons ranges from 20 to 40 inches. Coarse fragments range from 0 to 5 percent by volume.

The Ap horizon has value of 3 or 4 and chroma of 2 or 3. It is dominantly loamy sand but includes loamy fine sand or sand. Reaction ranges from medium acid to neutral. The A2 horizon has value of 5 or 6 and chroma of 4 to 6. It is loamy sand or sand. Reaction is medium acid or slightly acid. The B21t horizon is absent in some pedons. The IIB2t horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 8. It is clay loam, sandy clay loam, or loam. Reaction ranges from medium acid to mildly alkaline. The IIC horizon has value of 4 or 5 and chroma of 3 to 8. It is clay loam or loam.

Monitor series

The Monitor series consists of somewhat poorly drained soils on outwash plains. These soils formed in loamy outwash that is underlain by sand and gravel. Permeability is moderately slow. Slope ranges from 0 to 3 percent. These soils are browner in the solum than defined for the Monitor series, but this difference does not alter their usefulness or behavior.

Monitor soils are similar to Brady soils and are commonly adjacent to Brady, Coupee, Crosier, Ockley, and Sebewa soils. Brady soils are not as fine textured in the B horizon. Coupee soils are well drained. Crosier soils do not have the loamy sand underlying material. Ockley soils are well drained and are on higher ridges and knolls. Sebewa soils are poorly drained and are in shallow depressions and natural drainageways.

Typical pedon of Monitor loam, 0 to 3 percent slopes, 2,640 feet south and 2,040 feet west of the NE corner of sec. 19, T. 8 S., R. 18 W.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) loam; grayish brown (10YR 5/2) dry; moderate medium granular structure; friable; common fine roots; 3 percent pebbles; slightly acid; abrupt smooth boundary.

B21g—9 to 16 inches; grayish brown (10YR 5/2) silt loam; common medium distinct dark grayish brown (10YR 4/2) and dark yellowish brown (10YR 4/4) mottles; moderate medium subangular blocky structure; friable; few thin dark grayish brown (10YR 4/2) clay films on faces of peds; few fine roots; 2 percent pebbles; medium acid; clear wavy boundary.

B22t—16 to 28 inches; dark yellowish brown (10YR 3/4) sandy clay loam; common medium distinct grayish brown (10YR 5/2) and dark brown (7.5YR 3/2) mottles; moderate medium subangular blocky structure; friable; common thin clay bridgings between sand grains; few fine roots; 5 percent pebbles; medium acid; clear wavy boundary.

B23t—28 to 45 inches; dark brown (7.5YR 4/4) clay loam; common medium distinct grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; friable; common thin grayish brown (10YR 5/2) clay films on faces of peds; few fine roots; 5 percent pebbles; medium acid; gradual wavy boundary.

B3—45 to 55 inches; dark yellowish brown (10YR 4/4) sandy loam; common medium distinct grayish brown (10YR 5/2) mottles; weak medium subangular blocky structure; friable; 5 percent pebbles; medium acid; clear wavy boundary.

IICg—55 to 60 inches; grayish brown (10YR 5/2) gravelly loamy sand; common medium distinct yellowish brown (10YR 5/4) mottles; single grain; loose; 15 percent pebbles; slightly acid.

Thickness of the solum ranges from 40 to 60 inches. Coarse fragments range from 2 to 20 percent by volume.

The Ap horizon has chroma of 2 or 3. It is commonly loam but the range includes sandy loam and silt loam. Some pedons have an A2 horizon or a B1 horizon, or both. The B2t horizon has hue of 10YR or 7.5YR, value of 3 to 5, and chroma of 2 to 4. It is clay loam, sandy clay loam, silty clay loam, silt loam, and heavy sandy

loam. It ranges from strongly acid to slightly acid. Some pedons have a B3 horizon. The C horizon has value of 4 to 6 and chroma of 2 to 4. It is loamy sand, sand, coarse sand, and gravelly sand. It is slightly acid to moderately alkaline.

Morley series

The Morley series consists of well drained soils on till plains. These soils formed in calcareous loamy and clayey glacial till. Permeability is slow. Slope ranges from 12 to 25 percent.

Morley soils are similar to Riddles soils and are commonly adjacent to Blount, Glynwood, and Riddles soils. Blount soils are somewhat poorly drained and are in shallow depressions and drainageways. Glynwood soils are moderately well drained. They have gray mottling in the upper 10 inches of the B horizon and are on the more level areas and in slight depressions. Riddles soils are not so clayey in the subsoil.

Typical pedon of Morley silt loam, 12 to 18 percent slopes, 2,730 feet south and 102 feet east of the NW corner of sec. 20, T. 8 S., R. 20 W.

Ap—0 to 8 inches; dark brown (10YR 4/3) silt loam; moderate medium subangular blocky structure; friable; many fine roots; 5 percent pebbles; medium acid; abrupt smooth boundary.

B21t—8 to 17 inches; brown (10YR 4/3) clay loam; common fine distinct dark yellowish brown (10YR 4/6) and pale brown (10YR 6/3) mottles; moderate medium angular blocky structure; firm; many thin yellowish brown (10YR 5/4) clay films on faces of peds; few fine roots; 5 percent pebbles; strongly acid; gradual wavy boundary.

B22t—17 to 30 inches; dark brown (10YR 4/3) clay loam; moderate medium prismatic structure parting to moderate medium angular blocky; firm; many thin brown (10YR 5/3) clay films on faces of peds; few fine roots; 5 percent pebbles; medium acid; gradual wavy boundary.

B23t—30 to 40 inches; yellowish brown (10YR 5/4) silty clay loam; common medium distinct brown (10YR 4/3) mottles; moderate medium prismatic structure parting to moderate medium angular blocky; firm; many thin dark brown (10YR 3/3) clay films on faces of peds; few fine roots; 5 percent pebbles; mildly alkaline; abrupt wavy boundary.

C—40 to 60 inches; pale brown (10YR 6/3) silty clay loam; common medium distinct yellowish brown (10YR 5/6) and light gray (10YR 7/1) mottles; massive; firm; 5 percent pebbles; violent effervescence; moderately alkaline.

Thickness of the solum and depth to free carbonates range from 30 to 48 inches. Reaction in the solum ranges from strongly acid to mildly alkaline. Coarse fragments range from 2 to 10 percent by volume.

The Ap horizon has value of 3 or 4 and chroma of 2 or 3. It is dominantly silt loam but includes loam. The B2t horizon has value of 4 to 6 and chroma of 3 to 6. It is clay loam, clay, or silty clay loam and averages about 35 to 42 percent clay. The C horizon has value of 4 to 6 and chroma of 3 to 6. It is silty clay loam or clay loam.

Morocco series

The Morocco series consists of somewhat poorly drained soils on outwash plains. These soils formed in acid sands. Permeability is rapid. Slope ranges from 0 to 2 percent.

Morocco soils are similar to Thetford and Pipestone soils and are commonly adjacent to Granby, Oakville, Pipestone, Plainfield, and Thetford soils. Granby soils are poorly drained and in lower positions. Oakville soils are well drained and are on higher knolls and ridges. Plainfield soils are excessively drained and are on higher knolls and ridges. Thetford soils have an argillic horizon.

Typical pedon of Morocco loamy sand, 0 to 2 percent slopes, 200 feet south and 2,040 feet west of the NE corner of sec. 33, T. 3 S., R. 18 W.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) loamy sand; light brownish gray (10YR 6/2) dry; weak medium granular structure; very friable; many fine roots; less than 2 percent pebbles; strongly acid; abrupt wavy boundary.

A2—9 to 17 inches; pale brown (10YR 6/3) sand; few fine faint light brownish gray (10YR 6/2) mottles; medium round yellowish brown (10YR 5/6) Fe-Mn concretions; single grain; loose; few fine roots; less than 2 percent pebbles; strongly acid; clear wavy boundary.

B2—17 to 35 inches; yellowish brown (10YR 5/6) sand; common medium distinct light brownish gray (10YR 6/2) and pale brown (10YR 6/3) mottles; medium round yellowish brown (10YR 5/6) Fe-Mn concretions; single grain; loose; few fine and medium roots; less than 2 percent pebbles; strongly acid; clear wavy boundary.

C—35 to 60 inches; light brownish gray (10YR 6/2) sand; common medium faint pale brown (10YR 6/3) and common fine distinct yellowish brown (10YR 5/8) mottles; single grain; loose; less than 2 percent pebbles; strongly acid.

Thickness of the solum ranges from 29 to 48 inches. The Ap horizon has value of 3 or 4 and chroma of 1 or 2. It is dominantly loamy sand but includes loamy fine sand and sand. Reaction ranges from strongly acid to slightly acid. The B horizon has hue of 10YR or 7.5Y, value of 5 to 7, and chroma of 2 to 6. It is loamy fine sand, fine sand, or sand. Reaction ranges from very strongly acid to medium acid. The C horizon has value of 6 or 7 and chroma of 1 or 2. Reaction ranges from strongly acid to medium acid.

Oakville series

The Oakville series consists of well drained soils on outwash plains, moraines, sand dunes, and beach ridges. These soils formed in fine sand. Permeability is very rapid or rapid. Slope ranges from 0 to 45 percent.

Oakville soils are similar to Plainfield and Spinks soils and are commonly adjacent to Granby, Morocco, Pipestone, and Spinks soils. Granby soils are poorly drained and are in depressions and drainageways. Morocco and Pipestone soils are somewhat poorly drained and are in shallow depressions and drainageways. Plainfield soils have coarser sands. Spinks soils have loamy fine sand and loamy sand bands and lamellae.

Typical pedon of Oakville fine sand, 18 to 45 percent slopes, 75 feet east and 400 feet south of the NW corner of sec. 1, T. 3 S., R. 18 W.

A1—0 to 3 inches; very dark grayish brown (10YR 3/2) fine sand; grayish brown (10YR 5/2) dry; single grain; loose; many fine and medium roots; strongly acid; clear wavy boundary.

A2—3 to 10 inches; brown (10YR 4/3) fine sand; single grain; loose; many fine and medium roots; medium acid; abrupt wavy boundary.

B2—10 to 27 inches; yellowish brown (10YR 5/6) fine sand; single grain; loose; common medium and coarse roots; slightly acid; clear wavy boundary.

C—27 to 60 inches; very pale brown (10YR 7/4) fine sand; single grain, loose; neutral.

Thickness of the solum ranges from 18 to 40 inches. It is dominantly fine sand. Reaction ranges from strongly acid to neutral.

The A1 or Ap horizon has value of 2 to 4 and chroma of 1 or 2. It is dominantly fine sand but includes loamy sand and loamy fine sand. Thickness of the surface horizon ranges from 1 inch to 9 inches. The A2 horizon has value of 4 or 5 and chroma of 2 or 3. The B2 horizon has hue of 10YR and 7.5YR, value of 5 or 6, and chroma of 4 to 8. Some pedons have a B1 or B3 horizon, or both. The C horizon has value of 5 to 7 and chroma of 3 to 6. Reaction ranges from medium acid to neutral.

Ockley series

The Ockley series consists of well drained soils on outwash plains and moraines. These soils formed in thin loess and loamy drift overlying calcareous stratified gravel and sand. Permeability is moderate. Slope ranges from 0 to 18 percent.

Ockley soils are similar to Riddles soils and are commonly adjacent to Coupee, Martinsville, Monitor, Oshtemo, and Riddles soils. Coupee soils have less gravel in the subsoil. Martinsville soils do not have the coarse fragments and are stratified. Monitor soils are somewhat poorly drained and are in shallow depressions and drainageways. Oshtemo soils have less clay in the B2t horizon. Riddles soils do not have a sand and gravel IIC horizon.

Typical pedon of Ockley loam, 0 to 2 percent slopes, 108 feet south and 1,173 feet east of the NW corner of sec. 8, T. 7 S., R. 17 W.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) loam; pale brown (10YR 6/3) dry; weak medium granular structure; friable; many fine roots; 5 percent pebbles; slightly acid; abrupt smooth boundary.

B21t—9 to 24 inches; dark brown (7.5YR 4/4) gravelly clay loam; moderate medium subangular blocky structure; friable; many moderately thick dark yellowish brown (10YR 3/4) clay films on faces of peds; few fine roots; 15 percent pebbles; medium acid; clear wavy boundary.

B22t—24 to 33 inches; dark brown (7.5YR 4/4) gravelly sandy clay loam; moderate medium subangular blocky structure; friable; many thin clay bridgings; 15 percent pebbles; medium acid; abrupt wavy boundary.

B23t—33 to 38 inches; dark brown (7.5YR 4/4) sandy loam; weak medium granular structure; very friable; common thin clay bridgings; 5 percent pebbles; slightly acid; abrupt wavy boundary.

B24t—38 to 45 inches; dark brown (7.5YR 4/4) gravelly sandy clay loam; moderate medium subangular blocky structure; friable; few thin dark yellowish brown (10YR 3/4) clay films on faces of peds; 20 percent pebbles; slightly acid; abrupt wavy boundary.

B3—45 to 52 inches; dark yellowish brown (10YR 4/4) loamy sand; weak medium granular structure; very friable; neutral; clear wavy boundary.

IIC—52 to 60 inches; dark yellowish brown (10YR 4/4) gravelly coarse sand; single grain; loose; 15 percent pebbles; slight effervescence; mildly alkaline.

Thickness of the solum ranges from 40 to 60 inches. Depth to free carbonates ranges from 45 to 60 inches. Content of coarse fragments ranges from 0 to 15 percent by volume in the upper part of the solum and from 18 to 40 percent by volume in the lower part.

The Ap horizon has value of 4 or 5 and chroma of 2 to 6. It is dominantly loam but includes silt loam. Some pedons have a B1 horizon. The B2t horizon has hue of 10YR and 7.5YR, value of 3 to 5, and chroma of 3 to 6. It is gravelly clay loam, gravelly sandy clay loam, clay loam, sandy clay loam, sandy loam, or loam. Reaction ranges from strongly acid to neutral. The IIC horizon has value of 3 to 6 and chroma of 4 to 6. It is gravelly sand, loamy sand, sand, or gravel and sand. Reaction ranges from slightly acid to mildly alkaline.

Oshtemo series

The Oshtemo series consists of well drained soils on outwash plains and moraines. These soils formed in loamy and sandy material. Permeability is moderately rapid in the upper part of the subsoil and very rapid in the lower part. Slope ranges from 0 to 35 percent.

Oshtemo soils are similar to Spinks soils and are commonly adjacent to Brady, Coupee, Ockley, Plainfield, and Spinks soils. Brady soils are somewhat poorly drained and are in shallow depressions and drainageways. Coupee and Ockley soils have more clay in the B2t horizon. Plainfield soils do not have a Bt horizon. Spinks soils have loamy fine sand and loamy sand bands and lamellae.

Typical pedon of Oshtemo sandy loam, 0 to 6 percent slopes, 540 feet north and 1,800 feet east of the SW corner of sec. 34, T. 5 S., R. 18 W.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) sandy loam; light grayish brown (10YR 6/2) dry; moderate medium granular structure; very friable; common fine roots; less than 5 percent pebbles; strongly acid; abrupt smooth boundary.

A2—8 to 10 inches; dark yellowish brown (10YR 4/4) loamy fine sand; common medium distinct pale brown (10YR 6/3) and brown (10YR 5/3) mottles; weak medium subangular blocky structure; very friable; few fine roots; less than 5 percent pebbles; strongly acid; clear wavy boundary.

B21t—10 to 20 inches; dark brown (7.5YR 4/4) sandy loam; moderate medium angular blocky structure; friable; common thin clay bridgings between sand grains; few fine roots; less than 5 percent pebbles; medium acid; clear wavy boundary.

B22t—20 to 33 inches; dark reddish brown (5YR 3/4) sandy loam; moderate medium angular blocky structure; friable; common moderately thick dark reddish brown (5YR 3/4) clay films on faces of peds; few fine roots; 10 percent pebbles; strongly acid; abrupt wavy boundary.

B31—33 to 41 inches; dark brown (7.5YR 4/4) loamy sand; weak medium granular structure; very friable; 5 percent pebbles; strongly acid; abrupt wavy boundary.

B32—41 to 60 inches; yellowish brown (10YR 5/4) sand; and dark brown (7.5YR 4/4) loamy sand; single grain; loose; 5 percent pebbles; strongly acid; abrupt wavy boundary.

Thickness of the solum ranges from 40 to 63 inches. Coarse fragments range from 1 to 30 percent by volume. Reaction ranges from slightly acid to strongly acid.

The A horizon has value of 4 or 5 and chroma of 2 or 3. It is dominantly sandy loam but includes loamy sand. The A2 horizon has value of 4 or 5 and chroma of 3 or 4. Some pedons do not have an A2 horizon. The Bt horizon has hue of 10YR, 7.5YR, and 5YR; value of 3 to 5; and chroma of 3 to 6. It is sandy loam, sandy clay loam, gravelly sandy loam, or gravelly sandy clay loam. In the lower part of the solum, in some pedons, the Bt horizon is stratified sandy loam 1/8 inch to 4 inches thick separated by loamy sand. Some pedons have a B1 horizon or a B3 horizon, or both. Some pedons have a C horizon that is mildly alkaline.

Palms series

The Palms series consists of very poorly drained soils in depressional areas on lake plains, till plains, and moraines. These soils formed in deposits of organic material 16 to 50 inches thick over loamy deposits. Permeability is moderately slow to moderately rapid in the organic material and moderately slow in the underlying layers. Slope ranges from 0 to 2 percent.

Palms soils are similar to Adrian, Edwards, Houghton, and Kerston soils and are commonly adjacent to them. Adrian soils are muck soils that have sandy underlying material. Edwards soils are muck soils that have marly underlying material. Houghton soils consist entirely of organic material. Kerston soils have alternating layers of organic and mineral material.

Typical pedon of Palms muck, 2,240 feet north and 1,800 feet east of the SW corner of sec. 3, T. 8 S., R. 19 W.

Oa1—0 to 5 inches; black (5YR 2/1) broken face and rubbed sapric material; 20 percent fibers, less than 5 percent fibers rubbed; moderate medium granular structure; friable; many fine and medium roots; mainly herbaceous fibers; slightly acid; clear wavy boundary.

Oa2—5 to 16 inches; black (5YR 2/1) broken face and rubbed sapric material; 25 percent fibers, less than 5 percent fibers rubbed; moderate medium angular blocky structure; friable; many fine roots; mainly herbaceous fibers; slightly acid; abrupt smooth boundary.

Oa3—16 to 28 inches; very dark brown (10YR 2/2) broken face and rubbed sapric material; 20 percent fibers, less than 5 percent fibers rubbed; moderate thick platy structure; friable; few fine roots; mainly herbaceous fibers; medium acid; clear wavy boundary.

Oa4—28 to 40 inches; very dark gray (10YR 3/1) broken face, very dark brown (10YR 2/2) rubbed sapric material; 10 percent fibers; less than 5 percent fibers rubbed; massive; friable; few fine roots; mainly herbaceous fibers; neutral; abrupt wavy boundary.

IICg—40 to 60 inches; gray (10YR 5/1) clay loam; common medium distinct yellowish brown (10YR 5/6) mottles; massive; friable; neutral.

The organic layers are 16 to 50 inches deep over loamy material. The organic material is mainly herbaceous.

The surface layer has hue of 5YR, 7.5YR, or 10YR; value of 2; and chroma of 1 or 2. Reaction ranges from medium acid to mildly alkaline. The subsurface organic layers have hue of 10YR, 7.5YR, and 5YR; value of 2 or 3; and chroma of 0 to 3. Reaction ranges from strongly acid to mildly alkaline. The IICg horizon has hue of 10YR, 2.5Y, and 5Y; value of 4 to 7; and chroma of 1 or 2. It is sandy loam, loam, silt loam, clay loam, or silty clay loam. Reaction ranges from slightly acid to moderately alkaline.

Pella series

The Pella series consists of poorly drained soils in depressions on outwash plains, lake plains, and deltas. These soils formed in stratified, calcareous loamy and sandy materials. Permeability is moderate. Slope ranges from 0 to 2 percent.

Pella soils are similar to Lenawee soils and are commonly adjacent to Edwards, Kibbie, Lenawee, Poy, and Whitaker soils. Edwards soils are very poorly drained, have muck over marl, and are in slightly depressed areas. Kibbie soils are somewhat poorly drained and are on slightly higher plains and knolls. Lenawee and Poy soils have a fine textured B horizon. Whitaker soils are somewhat poorly drained, do not have a mollic epipedon, and are on slightly higher plains and knolls.

Typical pedon of Pella silt loam, 1,870 feet north and 2,340 feet west of the SE corner of sec. 26, T. 6 S., R. 19 W.

Ap—0 to 11 inches; black (N 2/0) silt loam; moderate medium granular structure; friable; common fine roots; neutral; abrupt smooth boundary.

B21g—11 to 21 inches; gray (10YR 5/1) silty clay loam; many coarse distinct very dark grayish brown (10YR 3/2) and common fine distinct olive brown (2.5Y 4/4) mottles; moderate medium subangular blocky structure; firm; few fine roots; very dark grayish brown (10YR 3/2) worm casts; neutral; abrupt wavy boundary.

B22g—21 to 32 inches; grayish brown (2.5Y 5/2) silty clay loam; few fine distinct gray (10YR 5/1) and common medium distinct olive brown (2.5Y 4/4) mottles; moderate medium angular blocky structure; firm; few fine roots; mildly alkaline; clear wavy boundary.

C1g—32 to 37 inches; gray (10YR 5/1) silty clay loam; common medium distinct olive brown (2.5Y 4/4) mottles; massive; firm; strong effervescence; mildly alkaline; clear wavy boundary.

IIC2g—37 to 56 inches; grayish brown (10YR 5/2) stratified silt loam and silty clay loam; common medium distinct yellowish brown (10YR 5/4) and common fine faint gray (10YR 5/1) mottles; massive; friable; strong effervescence; mildly alkaline; abrupt wavy boundary.

IIC3g—56 to 60 inches; yellowish brown (10YR 5/4) stratified loamy sand and silt loam; common medium distinct grayish brown (10YR 5/2) mottles; massive; very friable; strong effervescence; mildly alkaline.

Thickness of the solum and depth to free carbonates ranges from 20 to 40 inches. Thickness of the mollic epipedon ranges from 9 to 12 inches. Reaction in the solum typically ranges from slightly acid to mildly alkaline.

The A horizon has hue of 10YR or 2.5Y, value of 2 or 3, and chroma of 0 to 2. Texture is dominantly silt loam but includes fine sandy loam, loam, silty clay loam, and mucky analogs of each. The B2g horizon has hue of 10YR and 2.5Y, value of 4 to 6, and chroma of 1 or 2. Texture is silty clay loam, silt loam, clay loam, or loam. Some pedons have a IIB horizon. The Cg horizon has hue of 10YR, 5Y, or 2.5Y; value of 5 or 6; and chroma of 1 to 6. Texture is strata of loamy sand, silt loam, silty clay loam, and loam.

Pewamo series

The Pewamo series consists of poorly drained soils on lake plains and moraines. They formed in loamy and clayey glacial till or lacustrine sediment. Permeability is moderately slow. Slope ranges from 0 to 2 percent. These soils have less clay in the subsoil than defined for the Pewamo series, but this difference does not alter their usefulness or behavior.

Pewamo soils are similar to Lenawee and Rensselaer soils and are commonly adjacent to Belleville, Blount, Crosier, Glynwood, and Lenawee soils. Belleville soils do not have an argillic horizon and are sandy in the upper 20 to 40 inches. Blount and Crosier soils are somewhat poorly drained, do not have a mollic epipedon, and are on higher knolls and ridges. Glynwood soils are moderately well drained, do not have a mollic epipedon, and are on higher knolls and ridges. Lenawee soils are stratified. Rensselaer soils have less clay in the B horizon.

Typical pedon of Pewamo silt loam, 186 feet west and 252 feet south of the NE corner of sec. 2, T. 8 S., R. 20 W.

Ap—0 to 11 inches; very dark grayish brown (10YR 3/2) silt loam; grayish brown (10YR 5/2) dry; moderate medium granular structure; friable; many fine roots; less than 2 percent pebbles and cobbles; neutral; abrupt smooth boundary.

A12—11 to 15 inches; very dark gray (10YR 3/1) silt loam; moderate medium subangular blocky structure; friable; many fine roots; less than 2 percent pebbles and cobbles; neutral; abrupt wavy boundary.

B2tg—15 to 42 inches; grayish brown (10YR 5/2) silty clay loam; common medium distinct yellowish brown (10YR 5/6) mottles; moderate medium angular

blocky structure; firm; many thick gray (10YR 5/1) clay films on faces of peds; common fine roots; 5 percent pebbles; neutral; gradual wavy boundary.

C1g—42 to 55 inches; grayish brown (10YR 5/2) silty clay loam; many medium distinct yellowish brown (10YR 5/6) mottles; massive; firm; 5 percent pebbles; mildly alkaline; clear wavy boundary.

C2g—55 to 60 inches; gray (5Y 5/1) silty clay loam; many medium distinct yellowish brown (10YR 5/6) mottles; massive; firm; less than 5 percent pebbles; slight effervescence; mildly alkaline.

Thickness of the solum ranges from 30 to 50 inches. Coarse fragments range from 2 to 10 percent by volume. Thickness of the mollic epipedon ranges from 10 to 15 inches.

The A horizon has value of 2 or 3 and chroma of 1 or 2. It is dominantly silt loam but includes loam or clay loam. Reaction is slightly acid or neutral. The B2tg horizon has hue of 10YR, 2.5Y, or 5Y; value of 4 to 6; and chroma of 1 or 2. Reaction ranges from slightly acid to mildly alkaline. The Cg horizon has hue of 10YR, 2.5Y, or 5Y; value of 4 to 6; and chroma of 1 or 2. It is silty clay loam or loam.

Pipestone series

The Pipestone series consists of somewhat poorly drained soils on outwash plains, till plains, and sandy lake plains. These soils formed in sandy glaciofluvial deposits. Permeability is rapid. Slope ranges from 0 to 2 percent.

Pipestone soils are similar to Morocco and Thetford soils and are commonly adjacent to Granby, Morocco, Oakville, and Thetford soils. Granby soils are poorly drained. Morocco soils do not have a spodic horizon. Oakville soils are well drained and do not have a spodic horizon. Thetford soils have argillic bands and lamellae in the B horizon.

Typical pedon of Pipestone sand, 0 to 2 percent slopes, 1,172 feet south and 99 feet west of the NE corner of sec. 28, T. 3 S., R. 18 W.

Ap—0 to 8 inches; very dark brown (10YR 2/2) sand; moderate medium granular structure; very friable; many fine roots; slightly acid; abrupt smooth boundary.

A2—8 to 11 inches; grayish brown (10YR 5/2) sand; common medium distinct dark yellowish brown (10YR 3/4) mottles; moderate medium granular structure; very friable; common fine roots; medium acid; abrupt broken boundary.

B21hir—11 to 15 inches; dark reddish brown (5YR 3/3) sand; common fine prominent dark brown (7.5YR 4/4) mottles; weak medium subangular blocky structure; very friable; few fine roots; strongly acid; abrupt wavy boundary.

B22ir—15 to 31 inches; yellowish brown (10YR 5/6) sand; single grain; loose; medium acid; abrupt wavy boundary.

C—31 to 60 inches; light brownish gray (10YR 6/2) sand; single grain; loose; slightly acid.

Thickness of the solum is dominantly 20 to 40 inches. Reaction ranges from very strongly acid to slightly acid.

The Ap horizon has chroma of 1 or 2. It is dominantly sand, but the range includes loamy fine sand, loamy sand, and fine sand. The A2 horizon is absent in some pedons. The B21hir horizon has hue of 10YR, 7.5YR, or 5YR and value and chroma of 2 to 4. It is sand, fine sand, or loamy sand. The amount of ortstein commonly ranges from none to about 30 percent of the surface area that is exposed in a vertical cut through the B21hir horizon. The B22ir horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 4 to 8. It is sand or fine sand. Generally Fe-Mn concretions are present. The C horizon has hue of 10YR or 7.5YR, value of 5 to 7, and chroma of 2 to 6. It is sand, fine sand, or loamy sand.

Plainfield series

The Plainfield series consists of excessively drained soils on outwash plains, moraines, and beach ridges. These soils formed in sand. Permeability is rapid. Slope ranges from 0 to 6 percent.

Plainfield soils are similar to Oakville and Spinks soils and are commonly adjacent to Granby, Morocco, Oakville, Oshtemo, and Spinks soils. Granby soils are poorly drained and are in depressions and drainageways. Morocco soils are somewhat poorly drained and are in shallow depressions and drainageways. Oakville soils are well drained and formed in fine sands. Oshtemo soils are well drained and have an argillic horizon. Spinks soils are well drained and have a Bt horizon of lamellae bands.

Typical pedon of Plainfield sand, 0 to 6 percent slopes, 25 feet north and 760 feet west of the SE corner of sec. 32, T. 3 S., R. 18 W.

A1—0 to 5 inches; very dark gray (10YR 3/1) sand; gray (10YR 5/1) dry; weak fine granular structure; loose; many fine roots; medium acid; abrupt wavy boundary.

B1—5 to 19 inches; dark yellowish brown (10YR 4/4) sand; single grain; loose; many fine roots; strongly acid; gradual wavy boundary.

B2—19 to 33 inches; yellowish brown (10YR 5/4) sand; single grain; loose; common fine roots; strongly acid; gradual wavy boundary.

C—33 to 60 inches; light yellowish brown (10YR 6/4) sand; single grain; loose; medium acid.

Thickness of the solum ranges from 24 to 33 inches. Reaction ranges from medium acid to very strongly acid.

The A1 horizon has value of 3 or 4 and chroma of 2 or 3. Some pedons have an Ap horizon. It is dominantly

sand, but the range includes loamy sand and loamy fine sand. The B horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 3 to 6. The C horizon has value of 5 or 6 and chroma of 3 or 4. Reaction ranges from neutral to strongly acid.

Poy series

The Poy series consists of poorly drained soils on lake plains. These soils formed in stratified clayey material overlying sand. Permeability is slow or very slow in the subsoil and rapid in the underlying material. Slope ranges from 0 to 2 percent.

Poy soils are commonly adjacent to Monitor, Pella, Sebewa, and Whitaker soils. Monitor and Whitaker soils are somewhat poorly drained, have less clay in the B horizon, and are on higher ridges and knolls. Pella and Sebewa soils have less clay in the B horizon.

Typical pedon of Poy silt loam, 900 feet south and 474 feet west of the NE corner of sec. 28, T. 6 S., R. 19 W.

Ap—0 to 12 inches; very dark brown (10YR 2/2) silt loam; gray (10YR 5/1) dry; moderate medium granular structure; friable; many fine roots; medium acid; abrupt smooth boundary.

B21g—12 to 22 inches; dark grayish brown (10YR 4/2) clay; common fine distinct yellowish brown (10YR 5/6) and gray (10YR 5/1) mottles; strong coarse angular blocky structure; firm; few fine roots; slightly acid; abrupt wavy boundary.

IIC1g—22 to 27 inches; dark gray (10YR 4/1) loamy sand; common medium distinct grayish brown (10YR 5/2) and very dark grayish brown (10YR 3/2) mottles; weak medium subangular blocky structure; very friable; few fine roots; neutral; abrupt wavy boundary.

IIC2g—27 to 36 inches; light brownish gray (10YR 6/2) loamy fine sand; few fine distinct yellowish brown (10YR 5/6) mottles; weak fine granular structure; very friable; few fine roots; mildly alkaline; abrupt wavy boundary.

IIC3—36 to 45 inches; light yellowish brown (10YR 6/4) fine sand; few medium distinct light brownish gray (10YR 6/2) mottles; single grain; loose; mildly alkaline; clear wavy boundary.

IIC4g—45 to 60 inches; grayish brown (10YR 5/2) fine sand stratified with bands of silty clay loam 1/8 to 1/2 inch thick; common medium distinct gray (5Y 5/1) mottles; single grain; loose; slight effervescence; mildly alkaline.

Thickness of the solum and depth to sand or sand and gravel range from 20 to 35 inches. Reaction ranges from medium acid to neutral.

The Ap horizon has value of 2 or 3 and chroma of 0 to 2. It is dominantly silt loam but includes loam and sandy loam. The B21 horizon has hue of 10YR, 2.5Y, or 5Y; value of 4 to 6; and chroma of 1 or 2. It is clay, silty clay, silty clay loam, or clay loam. Some pedons have a B3g horizon. The IIC horizon has hue of 10YR, 2.5Y, or 5Y; value of 4 to 6; and chroma of 1 to 6. It is sand or coarse sand with thin strata of silty clay loam in some pedons.

Rensselaer series

The Rensselaer series consists of very poorly drained soils in nearly level or slightly depressed areas on till plains and moraines. These soils formed in loamy glacial drift. Slope ranges from 0 to 2 percent.

Rensselaer soils are similar to Pewamo soils and are commonly adjacent to Belleville, Crosier, and Selfridge soils. Belleville soils have sand over a loamy subsoil. Crosier soils are somewhat poorly drained. They are on slightly higher rises and knolls. Selfridge soils are somewhat poorly drained and have sand overlying the loamy material. They are on slightly higher rises and knolls. Pewamo soils have finer textures in the subsoil.

Typical pedon of Rensselaer silt loam, 147 feet south and 1,353 feet west of the NE corner of sec. 17, T. 8 S., R. 20 W.

Ap—0 to 10 inches; very dark grayish brown (10YR 3/2) silt loam; grayish brown (10YR 5/2) dry; moderate medium granular structure; friable; many fine roots; 2 percent pebbles; medium acid; abrupt smooth boundary.

B21g—10 to 19 inches; grayish brown (10YR 5/2) loam; common medium distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; friable; few thin grayish brown (10YR 5/2) clay films on faces of peds; common fine roots; 2 percent pebbles; slightly acid; gradual wavy boundary.

B22tg—19 to 35 inches; gray (10YR 5/1) silt loam; common medium distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; friable; common thin grayish brown (10YR 5/2) clay films on faces of peds; few fine roots; 2 percent pebbles; neutral; clear wavy boundary.

B23t—35 to 47 inches; yellowish brown (10YR 5/6) loam; common medium distinct gray (10YR 5/1) mottles; moderate medium subangular blocky structure; friable; common thin grayish brown (10YR 5/2) clay films on faces of peds; few fine roots; 2 percent pebbles; mildly alkaline; clear wavy boundary.

C1—47 to 51 inches; yellowish brown (10YR 5/4) silt loam; common medium distinct gray (10YR 5/1) and brown (7.5YR 5/2) mottles; massive; friable; light gray (10YR 7/1) lime streaks; 2 percent pebbles; slight effervescence; moderately alkaline; abrupt wavy boundary.

C2—51 to 60 inches; light yellowish brown (2.5Y 6/4) silt loam; common medium distinct gray (10YR 6/1) mottles; massive; friable; 2 percent pebbles; strong effervescence; moderately alkaline.

Thickness of the solum and depth to free carbonates range from 30 to 55 inches. Reaction in the solum is slightly acid to mildly alkaline, and content of pebbles ranges from 0 to 5 percent. Thickness of the mollic epipedon ranges from 10 to 14 inches.

The A horizon has value of 2 or 3 and chroma of 1 or 2. It is dominantly silt loam, but the range includes loam and silty clay loam. The B2 horizon has hue of 10YR and 2.5Y, value of 4 to 6, and chroma of 1 to 6. It is loam, silt loam, sandy loam, clay loam, or silty clay loam. The C horizon has hue of 10YR and 2.5Y, value of 4 to 6, and chroma of 1 to 6. It is silt loam, loam, clay loam, or fine sand.

Riddles series

The Riddles series consists of well drained soils on moraines and till plains. These soils formed dominantly in loam and sandy clay loam till. Permeability is moderate. Slope ranges from 1 to 45 percent.

Riddles soils are similar to Morley and Ockley soils, and are commonly adjacent to Crosier, Martinsville, Metea, Morley, and Ockley soils. The Crosier soils are somewhat poorly drained and are in shallow depressions and drainageways. Martinsville soils have stratified sand and silt underlying material. Metea soils have loamy sand over loamy material. Morley soils are fine textured. Ockley soils have sand and gravel underlying material.

Typical pedon of Riddles loam, 2 to 6 percent slopes, 2,244 feet north and 509 feet west of the SE corner of sec. 32, T. 3 S., R. 17 W.

Ap—0 to 7 inches; dark brown (10YR 3/3) loam; light brownish gray (10YR 6/3) dry; moderate medium granular structure; friable; many fine roots; 5 percent pebbles; medium acid; abrupt smooth boundary.

B1—7 to 11 inches; light yellowish brown (10YR 6/4) sandy clay loam; moderate medium angular blocky structure; friable; common fine roots; 5 percent pebbles; strongly acid; clear wavy boundary.

B2t—11 to 34 inches; yellowish brown (10YR 5/4) sandy clay loam; moderate medium angular blocky structure; firm; few thin brown (10YR 5/3) clay films on faces of peds; few fine roots; 5 percent pebbles; strongly acid; clear wavy boundary.

B3—34 to 55 inches; yellowish brown (10YR 5/4) sandy clay loam; few fine distinct brown (10YR 5/3) mottles; moderate medium subangular blocky structure; friable; few fine roots; 5 percent pebbles; strongly acid; gradual wavy boundary.

C—55 to 63 inches; dark yellowish brown (10YR 4/4) loam; common medium distinct brown (10YR 5/3) and yellowish brown (10YR 5/6) mottles; massive; friable; 10 percent pebbles; medium acid.

Thickness of the solum ranges from 40 to 70 inches. Reaction ranges from strongly acid to neutral. Coarse fragments throughout the solum range from 1 to 10 percent by volume.

The Ap horizon has value of 3 to 5 and chroma of 2 or 3. It is dominantly loam but ranges to silt loam, clay loam, or sandy loam. Some pedons have an A2 horizon or a B1 horizon, or both. The Bt horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 3 to 6. It is sandy clay loam, clay loam, sandy loam, loam, and silty clay loam. The C horizon has value of 4 or 5 and chroma of 3 or 4. Reaction ranges from medium acid to mildly alkaline. It is sandy clay loam, sandy loam, or loam.

Rimer series

The Rimer series consists of somewhat poorly drained soils on till plains and moraines. These soils formed in sandy deposits over fine textured till. Permeability is rapid in the subsoil and very slow in the underlying material. Slope ranges from 0 to 4 percent. These soils have coarser textured horizons in the upper part of the subsoil than defined for the Rimer series, but this difference does not alter their usefulness or behavior.

Rimer soils are similar to Selfridge soils and are commonly adjacent to Belleville, Blount, Glynwood and Morocco soils. Belleville soils are poorly drained, have a mollic epipedon, and are in shallow depressions and drainageways. Blount soils do not have the overlying sandy material. Glynwood soils are moderately well drained and do not have the overlying sandy material. Morocco soils do not have clay underlying material. Selfridge soils have less clay in the underlying material.

Typical pedon of Rimer loamy fine sand, 0 to 4 percent slopes, 2,440 feet south and 200 feet west of the NE corner of sec. 34, T. 4 S., R. 19 W.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) loamy fine sand; grayish brown (10YR 5/2) dry; weak medium granular structure; very friable; many fine roots; slightly acid; abrupt smooth boundary.

A21—9 to 12 inches; pale brown (10YR 6/3) loamy fine sand; common medium distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; very friable; common fine roots; slightly acid; clear wavy boundary.

A22—12 to 20 inches; pale brown (10YR 6/3) fine sand; few fine faint yellowish brown (10YR 5/4) mottles; single grain; loose; common fine and medium roots; neutral; abrupt wavy boundary.

A23—20 to 27 inches; yellowish brown (10YR 5/6) loamy fine sand; common medium distinct yellowish red (5YR 4/6) and few fine faint grayish brown (10YR 5/2) mottles; weak medium subangular blocky structure; very friable; few fine roots; neutral; abrupt wavy boundary.

A24—27 to 32 inches; pale brown (10YR 6/3) loamy fine sand; common medium distinct grayish brown (10YR 5/2) mottles; weak medium subangular blocky structure; very friable; few fine roots; mildly alkaline; abrupt wavy boundary.

IIB2t—32 to 41 inches; gray (5Y 5/1) clay; common medium distinct yellowish brown (10YR 5/6) mottles; moderate medium angular blocky structure; firm; common moderately thick gray (5Y 5/1) clay films on faces of peds; dark gray (10YR 4/1) root channels; few fine and medium roots; 1 percent pebbles; slight effervescence; moderately alkaline; abrupt wavy boundary.

IIC—41 to 60 inches; yellowish brown (10YR 5/4) clay; common medium distinct gray (5Y 5/1) mottles; massive; firm; light gray (10YR 7/1) lime streaks; 1 percent pebbles; slight effervescence; mildly alkaline.

Thickness of the solum and depth to free carbonates range from 24 to 48 inches. Depth to the fine textured underlying material ranges from 20 to 40 inches.

The Ap horizon has value of 3 or 4 and chroma of 2 or 3. It is dominantly loamy fine sand but ranges to loamy sand. Reaction ranges from strongly acid to neutral. The A2 horizon has value of 4 to 6 and chroma of 2 to 4. It is loamy fine sand, loamy sand, or sand. Reaction ranges from strongly acid to neutral. The B2t horizon has hue of 10YR or 7.5YR; value of 4, 5, or 6; and chroma of 3, 4, or 6. It is dominantly loamy fine sand but includes sandy loam and loamy sand. Reaction ranges from slightly acid to mildly alkaline. The IIB2t horizon has hue of 10YR, 2.5Y, or 5Y; value of 3 to 6; and chroma of 1 to 3. It is clay, silty clay loam, or clay loam. Reaction ranges from slightly acid to moderately alkaline. The IIC horizon is silty clay loam, clay, or clay loam. Reaction is mildly alkaline or moderately alkaline.

Sebewa series

The Sebewa series consists of poorly drained soils on outwash plains and lake plains. These soils formed in loamy over sandy glaciofluvial deposits. Permeability is moderate in the subsoil and rapid in the underlying material. Slope ranges from 0 to 2 percent.

Sebewa soils are similar to Gilford soils and are commonly adjacent to Gilford, Monitor, and Poy soils. Gilford soils are coarse textured in the B horizon. Monitor soils are somewhat poorly drained and are on higher areas, ridges, and knolls. Poy soils are more clayey in the subsoil.

Typical pedon of Sebewa loam, 1,760 feet south and 310 feet east of the NW corner of sec. 33, T. 5 S., R. 18 W.

Ap—0 to 13 inches; very dark brown (10YR 2/2) loam; gray (10YR 5/1) dry; moderate medium subangular blocky structure parting to moderate fine granular; friable; common fine roots; 7 percent pebbles; slightly acid; abrupt wavy boundary.

B21tg—13 to 23 inches; gray (10YR 5/1) clay loam; common medium faint light reddish brown (2.5YR 6/4) and common medium distinct strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; friable; common thin gray (10YR 5/1) clay films on faces of peds; few fine roots; 10 percent pebbles; neutral; clear wavy boundary.

B22tg—23 to 29 inches; gray (10YR 5/1) clay loam; common medium distinct strong brown (7.5YR 5/8) and common medium faint pale brown (10YR 6/3) mottles; moderate medium subangular blocky structure; friable; common thin gray (10YR 5/1) clay films on faces of peds; 5 percent pebbles; mildly alkaline; abrupt wavy boundary.

IIC1—29 to 47 inches; yellowish brown (10YR 5/4) sand; common medium faint yellowish brown (10YR 5/6) mottles; single grain; loose; 5 percent pebbles; slight effervescence; mildly alkaline; clear wavy boundary.

IIC2g—47 to 60 inches; gray (10YR 5/1) sand; single grain; loose; 2 percent pebbles; strong effervescence; moderately alkaline.

Thickness of the solum and depth to free carbonates range from 20 to 40 inches. Reaction in the solum ranges from slightly acid to mildly alkaline. Thickness of the mollic epipedon ranges from 10 to 13 inches.

The A horizon has value of 2 or 3 and chroma of 1 or 2. It is dominantly loam, but the range includes sandy loam and silt loam. The B2tg horizon has value of 4 or 5 and chroma of 1 or 2. It is clay loam or sandy clay loam. The IIC horizon has value of 5 or 6 and chroma of 1 to 4. It is sand, sand and gravel, or loamy sand. Reaction ranges from neutral to moderately alkaline. Effervescence is slight or strong.

Selfridge series

The Selfridge series consists of somewhat poorly drained soils on lake plains and till plains. These soils formed in sandy over loamy material. Permeability is rapid in the subsoil and moderate or moderately slow in the underlying material. Slope ranges from 0 to 3 percent.

Selfridge soils are similar to Rimer soils and are commonly adjacent to Belleville, Crosier, Metea, and Rensselaer soils. Rimer soils have clayey underlying material. Belleville soils are poorly drained and are in shallow depressions. Crosier soils do not have a sandy surface layer. Metea soils are well drained and are on higher positions of knolls and ridges. Rensselaer soils are poorly drained, do not have a sandy surface layer, and are in shallow depressions and drainageways.

Typical pedon of Selfridge loamy sand, 0 to 3 percent slopes, 1,400 feet north and 273 feet east of the SW corner of sec. 28, T. 3 S., R. 17 W.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) loamy sand; light gray (10YR 6/1) dry; weak medium granular structure; very friable; many fine roots; slightly acid; abrupt smooth boundary.

A21—9 to 23 inches; pale brown (10YR 6/3) loamy sand; few medium faint light brownish gray (10YR 6/

2) mottles; weak medium granular structure; very friable; common fine roots; slightly acid; abrupt wavy boundary.

A22—23 to 32 inches; light brownish gray (10YR 6/2) loamy sand; common medium distinct dark yellowish brown (10YR 4/4) mottles; strong coarse angular blocky structure; very friable; few fine roots; slightly acid; abrupt wavy boundary.

B21t—32 to 35 inches; strong brown (7.5YR 5/6) sandy loam; few medium distinct grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; friable; few thin clay bridgings between sand grains; 2 percent pebbles; slightly acid; clear wavy boundary.

IIB22t—35 to 40 inches; strong brown (7.5YR 5/6) clay loam; few medium distinct grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; friable; few thin grayish brown (10YR 5/2) clay films on faces of peds; 2 percent pebbles; neutral; abrupt wavy boundary.

IIC—40 to 60 inches; grayish brown (10YR 5/2) loam; common medium distinct strong brown (7.5YR 5/6) mottles; massive; friable; 2 percent pebbles; slight effervescence; mildly alkaline.

Depth to the IIC horizon and thickness of the solum range from 24 to 40 inches. Reaction in the solum ranges from medium acid to neutral. Coarse fragments range from 0 to 5 percent by volume.

The Ap horizon has value of 2 or 3 and chroma of 1 or 2. It is dominantly loamy sand, but the range includes sand. The A21 horizon has value of 4 to 6 and chroma of 3 to 6. It is sand, loamy sand, or loamy fine sand. The A22 horizon has value of 5 or 6 and chroma of 2 to 6. It is sand, fine sand, or loamy sand. The B2t horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 2 to 6. It is sandy loam or loam. The IIB horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 1 to 6. It is loam, clay loam, or silt loam. The IIC horizon is loam, silt loam, clay loam, or silty clay loam.

Shoals series

The Shoals series consists of somewhat poorly drained soils on flood plains of major creeks and rivers. These soils formed in alluvium. Permeability is moderate. Slope ranges from 0 to 2 percent.

Shoals soils are commonly adjacent to Abscota, Cohoctah, and Landes Variant soils. Abscota soils are sandy, well drained, and are on higher ridges. Cohoctah soils are poorly drained, have more sand in the pedon, and are in shallow depressions and drainageways. Landes Variant soils are moderately well drained, have more sand in the B horizon, and are on higher positions of ridges and knolls.

Typical pedon of Shoals silt loam, 0 to 2 percent slopes, 693 feet north and 1,073 feet east of the SW corner of sec. 27, T. 5 S., R. 18 W.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) silt loam; light brownish gray (10YR 6/2) dry; moderate medium granular structure; friable; many fine roots; moderately alkaline; abrupt smooth boundary.

C1—9 to 17 inches; grayish brown (10YR 5/2) silt loam; common fine distinct yellowish brown (10YR 5/6) mottles; moderate medium granular structure; friable; dark brown (10YR 4/3) worm casts; common fine roots; mildly alkaline; clear wavy boundary.

C2—17 to 21 inches; strong brown (7.5YR 5/6) silt loam; common fine distinct grayish brown (10YR 5/2) mottles; common medium subangular blocky structure; friable; dark grayish brown (10YR 4/2) worm casts; many fine roots; moderately alkaline; clear wavy boundary.

C3—21 to 33 inches; dark grayish brown (10YR 4/2) silt loam; common medium distinct yellowish brown (10YR 5/6) mottles; common fine subangular blocky structure; friable; few fine roots; moderately alkaline; abrupt wavy boundary.

C4—33 to 40 inches; light brownish gray (10YR 6/2) loamy very fine sand; common medium distinct yellowish brown (10YR 5/6) mottles; weak fine granular structure; very friable; few fine roots; slight effervescence; moderately alkaline; gradual wavy boundary.

C5—40 to 47 inches; yellowish brown (10YR 5/6) fine sandy loam; common medium distinct light brownish gray (10YR 6/2) mottles; weak medium granular structure; very friable; slight effervescence; moderately alkaline; abrupt wavy boundary.

C6—47 to 53 inches; grayish brown (10YR 5/2) loamy fine sand; single grain; loose; slight effervescence; moderately alkaline; abrupt wavy boundary.

IIC7—53 to 60 inches; grayish brown (10YR 5/2) sand and gravel; single grain; loose; 20 percent pebbles; slight effervescence; moderately alkaline.

Reaction of the control section ranges from neutral to moderately alkaline.

The A horizon has value of 4 or 5 and chroma of 2. It is dominantly silt loam but includes loam. The C horizon has hue of 10YR, 7.5YR, or 2.5Y; value of 4 to 6; and chroma of 2 to 6. It is stratified loam, silt loam, loamy very fine sand, sandy loam, and loamy fine sand. Sand and gravel are common below a depth of 50 inches.

Spinks series

The Spinks series consists of well drained soils on moraines, till plains, outwash plains, and beach ridges. These soils formed in sandy material. Permeability is moderately rapid or rapid. Slope ranges from 0 to 18 percent.

Spinks soils are similar to Oakville and Oshtemo soils and are commonly adjacent to Metea, Oshtemo, Plainfield, and Thetford soils. Metea soils have loamy underlying material. Oakville and Plainfield soils do not

have a Bt horizon. Oshtemo soils have a finer textured Bt horizon and have more pebbles. Thetford soils are somewhat poorly drained and are in shallow depressions and drainageways.

Typical pedon of Spinks loamy fine sand, 0 to 6 percent slopes, 960 feet north and 520 feet east of the SW corner of sec. 17, T. 3 S., R. 17 W.

Ap—0 to 10 inches; dark brown (10YR 4/3) loamy fine sand; moderate medium granular structure; very friable; neutral; abrupt smooth boundary.

A2—10 to 16 inches; light yellowish brown (10YR 6/4) fine sand; weak medium granular structure; very friable; neutral; abrupt wavy boundary.

A&B—16 to 32 inches; brownish yellowish (10YR 6/6) fine sand (A2); single grain; loose; lamellae and bands of dark brown (7.5YR 4/4) loamy fine sand (B2t); weak medium subangular blocky structure in thicker bands; very friable; wavy and discontinuous 1/4- to 1-inch-thick bands with a total accumulation of 8 inches; strongly acid; abrupt wavy boundary.

B2—32 to 40 inches; dark brown (7.5YR 4/4) sand; weak medium subangular blocky structure; very friable; 15 percent pebbles; strongly acid; clear wavy boundary.

A'&B'—40 to 60 inches; light brown (10YR 6/4) fine sand (A'); single grain; loose; lamellae and bands of dark brown (7.5YR 4/4) loamy fine sand (B'2t); few fine prominent dark reddish brown (5YR 3/2) Fe-Mn concretions; weak fine granular structure; very friable; dark grayish brown (10YR 4/2) clay bridgings between sand grains; strongly acid.

Thickness of the solum ranges from 36 to 60 inches. Reaction ranges from strongly acid to mildly alkaline.

The A horizon has value of 3 or 4 and chroma of 2 or 3. It is dominantly loamy fine sand but includes loamy sand. The A2 horizon has value of 5 or 6 and chroma of 3 to 6. It is fine sand, loamy fine sand, or loamy sand. The B2t horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6. It is loamy fine sand or loamy sand. Some pedons have a C horizon. If present, it has hue of 10YR, value of 5 to 7, and chroma of 3 or 4. It is fine sand or sand.

Thetford series

The Thetford series consists of somewhat poorly drained soils on moraines, lake plains, till plains, outwash plains, and beach ridges. These soils formed in sand. Permeability is moderately rapid. Slope ranges from 0 to 3 percent. These soils have a more acid solum than defined for the Thetford series, but this difference does not alter their usefulness or behavior.

Thetford soils are similar to Morocco and Pipestone soils and are commonly adjacent to Brady, Granby, and Oakville soils. Brady soils have a continuous Bt horizon. Granby soils are poorly drained and have a mollic epipedon. Oakville, Morocco, and Pipestone soils do not have a Bt horizon. They are on the dunes, ridges, and knolls.

Typical pedon of Thetford loamy sand, 0 to 2 percent slopes, 402 feet east and 1,878 feet north of the SW corner of sec. 16, T. 3 S., R. 17 W.

Ap—0 to 10 inches; dark brown (10YR 4/3) loamy sand; moderate fine granular structure; very friable; slightly acid; abrupt smooth boundary.

B2—10 to 20 inches; brownish yellow (10YR 6/6) fine sand; common medium faint yellowish brown (10YR 5/6) and common medium distinct light brownish gray (10YR 6/2) mottles; weak fine granular structure; very friable; strongly acid; gradual wavy boundary.

A2—20 to 31 inches; very pale brown (10YR 7/3) fine sand; common medium distinct light brownish gray (10YR 6/2) and common medium prominent strong brown (7.5YR 5/8) mottles; single grain; loose; strongly acid; abrupt wavy boundary.

A&B—31 to 60 inches; pale brown (10YR 6/3) fine sand (A2); common medium faint light gray (10YR 7/2) and common medium prominent yellowish red (5YR 5/6) mottles; single grain; loose; lamellae and bands of yellowish brown (10YR 5/4) loamy fine sand (Bt); few medium distinct light brownish gray (10YR 6/2) and common medium distinct yellowish brown (10YR 5/8) mottles; weak coarse subangular blocky structure in thicker bands; friable; wavy and discontinuous 1- to 6-inch-thick bands with a total accumulation of 18 inches; strongly acid.

Thickness of the solum ranges from 30 to more than 60 inches. The amount of pebble-size coarse fragments is 0 to 5 percent. Reaction in the solum is strongly acid to neutral.

The Ap horizon has value of 4 or 3 and chroma of 3 or 2. It is dominantly loamy sand, but the range includes loamy fine sand. The B1 horizon has value of 4 to 6 and chroma of 3 to 6. The texture is loamy sand, loamy fine sand, sand, or fine sand. The A2 horizon is absent in some pedons. The A&B horizon has hue of 10YR or 7.5YR. The A part has chroma of 2 or 3 and is sand, fine sand, or loamy sand. The B part has value of 4 or 5 and chroma of 3 or 4 and is loamy sand, loamy fine sand, or sandy loam. Some pedons have a C horizon. The C horizon has value of 5 or 6 and chroma of 2 or 4 and is sand or fine sand.

Tustin series

The Tustin series consists of well drained soils on till plains and moraines. These soils formed in sandy deposits over clayey and loamy till. Permeability is rapid in the subsoil and slow in the underlying material. Slope ranges from 2 to 12 percent.

Tustin soils are similar to Metea soils and are commonly adjacent to Glynwood, Rimer, and Spinks

soils. Metea soils have less clay in the underlying material. Glynwood soils are moderately well drained and do not have sandy subsoil material. Rimer soils are somewhat poorly drained and are in shallow depressions and drainageways. Spinks soils do not have a clayey subsoil and are in the same position on knolls and ridges as Tustin soils.

Typical pedon of Tustin loamy fine sand, 2 to 6 percent slopes, 2,520 feet north and 760 feet west of the SE corner of sec. 18, T. 3 S., R. 17 W.

Ap—0 to 9 inches; brown (10YR 4/3) loamy fine sand; pale brown (10YR 6/3) dry; weak medium granular structure; very friable; many fine roots; medium acid; abrupt wavy boundary.

A21—9 to 14 inches; yellowish brown (10YR 5/6) loamy fine sand; very weak medium subangular blocky structure; very friable; common fine roots; medium acid; clear wavy boundary.

A22—14 to 36 inches; light yellowish brown (10YR 6/4) fine sand; single grain; loose; few fine roots; slightly acid; abrupt wavy boundary.

IIB2t—36 to 56 inches; yellowish brown (10YR 5/4) silty clay; moderate medium subangular blocky structure; firm; common moderately thick grayish brown (10YR 5/2) clay films on faces of peds; neutral; clear wavy boundary.

IIC—56 to 60 inches; yellowish brown (10YR 5/4) silty clay loam; common fine distinct grayish brown (10YR 5/2) and yellowish brown (10YR 5/6) mottles; massive; firm; mildly alkaline.

Thickness of the solum and depth to free carbonates ranges from 50 to more than 60 inches. Depth to the fine textured underlying material is 20 to 40 inches.

The Ap horizon has value of 3 or 4 and chroma of 2 or 3. It is dominantly loamy fine sand but includes loamy sand and sand. Reaction ranges from medium acid to neutral. The A2 horizon has hue of 10YR or 7.5YR and value and chroma of 4 to 6. It is fine sand, loamy fine sand, or loamy sand. Reaction ranges from medium acid to neutral. Some pedons have a B2t horizon. The IIB2t horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. It is silty clay loam, clay loam, or silty clay. Reaction ranges from slightly acid to mildly alkaline. The IIC horizon has hue of 10YR or 7.5YR, value of 4 or 5, chroma of 3 to 6. It is clay loam, silty clay loam, or silty clay. Reaction is mildly alkaline or moderately alkaline.

Whitaker series

The Whitaker series consists of somewhat poorly drained soils on lake plains and outwash plains. These soils formed in stratified loamy and sandy outwash or lacustrine material. Permeability is moderate. Slope ranges from 0 to 2 percent.

Whitaker soils are similar to Kibbie soils and are commonly adjacent to Martinsville, Pella, and Poy soils. Kibbie soils do not have stratified loamy underlying material and have a mollic epipedon. Martinsville soils are well drained and are on higher knolls and ridges. Poy soils are poorly drained, have a mollic epipedon, have a clayey subsoil, and are in depressions and drainageways.

Typical pedon of Whitaker loam, 0 to 2 percent slopes, 294 feet south and 2,553 feet east of the NW corner of sec. 8, T. 8 S., R. 19 W.

Ap—0 to 10 inches; dark grayish brown (10YR 4/2) loam; light brownish gray (10YR 6/2) dry; moderate medium granular structure; friable; common fine roots; slightly acid; abrupt smooth boundary.

B21t—10 to 20 inches; grayish brown (10YR 5/2) and gray (10YR 5/1) silty clay loam; common medium prominent strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; firm; few thin brown (10YR 5/3) clay films on faces of peds; few fine roots; medium acid; abrupt wavy boundary.

B22t—20 to 30 inches; yellowish brown (10YR 5/4) loamy sand; common fine distinct light brownish gray (10YR 6/2) mottles; weak medium subangular blocky structure; very friable; few thin clay bridgings between sand grains; few fine roots; medium acid; abrupt wavy boundary.

B23t—30 to 38 inches; gray (10YR 5/1) silty clay loam; common medium distinct dark yellowish brown (10YR 4/6) mottles; strong coarse subangular blocky structure; firm; few thin gray (10YR 5/1) clay films on faces of peds; few fine roots; medium acid; clear wavy boundary.

C1—38 to 44 inches; strong brown (7.5YR 5/6) silty clay loam; common medium distinct gray (10YR 5/1) mottles; massive; firm; strongly acid; abrupt wavy boundary.

C2—44 to 50 inches; yellowish brown (10YR 5/8) sandy clay loam; common medium distinct grayish brown (10YR 5/2) mottles; massive; friable; medium acid; clear wavy boundary.

C3—50 to 60 inches; grayish brown (10YR 5/2) stratified sandy loam, sand, and clay loam; massive; friable; slightly acid.

Thickness of the solum ranges from 36 to 50 inches. Reaction ranges from strongly acid to neutral.

The Ap horizon has value of 4 or 3 and chroma of 2 or 3. It is dominantly loam but includes silt loam and sandy loam. The B2t horizon has hue of 10YR, 2.5Y, or 7.5YR; value of 4 to 6; and chroma of 1 to 4. It is silty clay loam, clay loam, loam, and loamy sand. Content of clay averages about 23 to 31 percent. The IIC horizon has value of 4 to 6 and chroma of 1 or 2. It is stratified clay loam, sandy clay loam, silty clay loam, sandy loam, loamy fine sand, and sand with thin strata of clay or silty clay. Reaction ranges from medium acid to mildly alkaline.

formation of the soils

The paragraphs that follow describe the factors of soil formation, relate them to the formation of soils in the survey area, and explain the processes of soil formation.

factors of soil formation

Soil forms through the interaction of five major factors: the physical, chemical, and mineralogical composition of the parent material; the climate under which the soil material has accumulated and existed since accumulation; the plant and animal life on and in the soil; the relief, or lay of the land, including the depth to the water table; and the length of time the processes of soil formation have acted on the parent material.

Climate and plant and animal life are the active forces in soil formation. They slowly change the parent material into a natural body of soil that has genetically related layers, called horizons. The effects of climate and plant and animal life are conditioned by relief. The nature of the parent material also affects the kind of soil profile that is formed and, in extreme cases, determines it almost entirely. Finally, time is needed for changing the parent material into a soil profile. It can be a long or short time, but some time is required for differentiation of soil horizons. Generally, a long time is required for the formation of distinct horizons.

The factors of soil formation are so closely interrelated in their effects on the soils that few generalizations can be made regarding the effect of any one factor unless conditions are specified for the other four. Many of the processes of soil formation are unknown.

parent material

Parent material is the unconsolidated mass from which a soil forms. The parent materials of the soils of Berrien County were deposited by glaciers or meltwater from the glaciers. These parent materials were reworked and redeposited by subsequent actions of water and wind. Glaciers covered the county from about 10,000 to 12,000 years ago. Parent material determines the limit of the chemical and mineralogical composition of the soil. Although most parent materials are of common glacial origin, their properties vary greatly, sometimes within small areas, depending on how the materials were deposited. The dominant parent materials in Berrien County were deposited as glacial till, outwash deposits, lacustrine deposits, alluvium, and organic material.

Glacial till is material laid down directly by glaciers with a minimum of water action. It consists of particles of different sizes that are mixed together. The small pebbles in glacial till have sharp corners, indicating that they have not been worn by water washing.

The glacial till in Berrien County is dominantly deeply leached of carbonates. Much of the till contains black hard shale that originated from the bedrock over which the glacier flowed. The shale originally contained iron sulphates that have accelerated the leaching process. The texture of the till is loamy sand, sandy loam, loam, silty clay loam, or clay loam. The Riddles and Crosier soils, for example, formed in glacial till.

A few areas of soils in Berrien County have not been deeply leached of carbonates. The Selfridge and Pewamo soils are examples of these soils.

Outwash material is deposited by running water from melting glaciers. The size of the particles that make up outwash material depends upon the speed of the stream of water that carried them. When the water slows down, the coarser particles are deposited. Finer particles, such as very fine sand, silt, and clay, can be carried by slowly moving water. Outwash deposits generally consist of layers of particles of similar size, such as sandy loam, sand, gravel, or other coarse particles. The Oshtemo soils, for example, formed in deposits of outwash material.

Lacustrine material is deposited from still, or ponded, glacial meltwater. Because the coarser fragments drop out of moving water as outwash, only the finer particles, such as very fine sand, silt, and clay, remain to settle out in still water. In Berrien County, soils that formed in lacustrine deposits are coarse to fine textured. Poy soils, for example, formed in lacustrine material.

Alluvial material is deposited by floodwaters of present streams in recent time. This material has various textures, depending on the speed of the water from which it was deposited. An example of an alluvial soil is the Cohoctah soil.

Organic material consists of deposits of plant remains. After the glaciers withdrew from the area, water remained standing in depressions in outwash plains, flood plains, moraines, and till plains. Grasses and sedges growing around the edges of these lakes died, and the residue fell to the bottom. Because the areas were wet, the plant remains did not decompose, but remained around the edge of the lake. Later, water tolerant trees grew on the areas. After these trees died,

the residue became part of the organic accumulation. Consequently, the lakes were eventually filled with organic material and developed into areas of muck. Houghton and Edwards soils formed in organic material.

plant and animal life

Green plants have been the principal organism influencing the soils in Berrien County. Bacteria, fungi, earthworms, and the activities of man, however, have also been important. The chief contribution of plant and animal life is the addition of organic matter and nitrogen to the soil. The kind of organic material on and in the soil depends upon the kinds of plants that grew on the soil. Residue of these plants accumulated on the surface of the soil, decayed, and eventually became organic matter. Roots of the plants provide channels for downward movement of water through the soil and also add organic matter as they decay. Bacteria in the soil help to break down the organic matter so that it can be used by growing plants.

The vegetation in Berrien County was mainly deciduous forest, with areas of prairie and scrub oak savannahs in the southern part. Differences in natural soil drainage and changes in parent material affect the composition of forest species.

In general, the well drained upland soils, such as the Morley, Riddles, and Oshtemo soils, were mainly covered with white oak, tulip poplar, sugar maple, and hickory. The Coupee soils, however, were covered with prairie vegetation.

The wet soils were covered mainly by soft maple, swamp white oak, elm, and ash. The Gilford and Pewamo soils formed under wet conditions, and they contain considerable organic matter.

climate

Climate is important in the formation of soils. It determines the kind of plant and animal life on and in the soil, and it determines the amount of water available for weathering minerals and for transporting soil material. Climate, through its influence on soil temperatures, determines the rate of chemical reaction occurring in the soil. These influences are important but affect large areas rather than a relatively small area, such as a county.

The climate in Berrien County is cool and humid. This is presumably similar to that which existed when the soils formed. The soils in Berrien County differ from soils that formed in a dry, warm climate or from those that formed in a moist, hot climate. Climate is uniform throughout the county. Areas adjacent to Lake Michigan and a few miles eastward, however, receive somewhat more precipitation, especially snowfall, than other parts of the county. Only minor differences in the soils of Berrien County are the result of the differences in climate.

relief

Relief, or topography, has a marked influence on the soils of Berrien County through its influence on natural drainage, erosion, plant cover, and soil temeprature. In this county, slopes range from 0 to 90 percent. Natural soil drainage ranges from well drained on the ridgetops to very poorly drained in the depressions.

Relief influences the formation of soils by affecting runoff and drainage. Drainage, in turn, through its effect on aeration of the soil, determines the color of the soil. Runoff is greatest on the steeper slopes. In low areas, water is temporarily ponded. Water and air move freely through soils that are well drained but slowly through soils that are very poorly drained. In soils that are well aerated, the iron and aluminum compounds that give most soils their color are brightly colored and oxidized. In poorly aerated soils, the color is dull gray and mottled. Ockley soils are an example of well drained, well aerated soils. Sebewa soils are an example of poorly aerated, poorly drained soils. Both formed in similar parent material.

time

Generally, a long time is required by the agents of soil formation to develop distinct horizons from parent material. The differences in the length of time that the parent materials have been in place are commonly reflected in the degree of development of the soil profile. Some soils develop rapidly, others slowly.

The soils in Berrien County range from young to mature. The glacial deposits from which many of the soils formed have been exposed to soil forming factors long enough to allow distinct horizons to develop. Some soils forming in recent alluvial sediment have not been in place long enough for distinct horizons to develop. The Cohoctah series is an example of a young soil that formed in alluvial material. The Oshtemo series is an example of the effect of more time on leaching of lime from the soil.

genesis and morphology

The processes, or soil forming factors, responsible for the development of the soil horizons from the unconsolidated parent material are referred to as soil genesis. The physical, chemical, and biological properties of the various soil horizons are termed soil morphology.

Several processes were involved in the development of soil horizons in Berrien County: (1) accumulation of organic matter, (2) leaching of lime (calcium carbonates) and other bases, (3) reduction and transfer of iron, and (4) formation and translocation of silicate clay minerals. In most soils more than one of these processes has been active in the development of the horizon.

Organic matter accumulated at the surface to form an A1 horizon. The A1 horizon is mixed into a plow layer

(Ap) when the soil is plowed. In the soils of Berrien County, the surface layer ranges from high to low in organic matter content. Coupee soils, for example, have high organic matter content in the surface layer, and the Plainfield soils have low organic matter content.

Leaching of carbonates and other bases occurred in most of the soils. Soil scientists generally agree that leaching of bases in soils usually precedes the translocation of silicate clay minerals. Many of the soils are moderately to strongly leached. For example, Martinsville soils are leached of carbonates to a depth of 54 inches, whereas Shoals soils are leached to a depth of only 30 inches. Differences in the depths of leaching is a result of time.

The reduction and transfer of iron, a process called gleying, is evident in the somewhat poorly drained, poorly drained, and very poorly drained soils. The gray color in the subsoil indicates the reduction and loss of iron. Pella soils exhibit gleying and the reduction processes.

Translocation of clay minerals has contributed to horizon development. An eluviated, or leached, A2 horizon above an illuviated B horizon has a platy structure, is lower in content of clay, and typically is lighter in color. The B horizon typically has an accumulation of clay (clay films) in pores and on ped surfaces. Soils displaying this translocation of clay were probably leached of carbonates and soluble salts to a considerable extent before translocation of silicate clay took place. Leaching of bases and translocation of silicate clays are among the more important processes in horizon differentiation. The Morley soil is an example of a soil that has translocated silicate clays in the form of clay films accumulated in the B horizon.

In some soils, iron, aluminum, and humus have moved from the surface layer to the B horizon. The color of the B horizon in such soils is dark brown. The Pipestone soils are an example of soils in which translocated iron, aluminum, and humus have affected the B horizon.

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glossary

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	More than 12

Base saturation. The degree to which material having cation exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation exchange capacity.

Bench terrace. A raised, level or nearly level strip of earth constructed on or nearly on a contour, supported by a barrier of rocks or similar material, and designed to make the soil suitable for tillage and to prevent accelerated erosion.

Blinding material. Topsoil, straw, hay, sawdust, or other material placed on the sides of and over tile lines to protect alinement during backfilling and to improve permeability in the tile zone.

Blowout. A shallow depression from which all or most of the soil material has been removed by wind. A blowout has a flat or irregular floor formed by a resistant layer or by an accumulation of pebbles or cobbles. In some blowouts the water table is exposed.

Bottom land. The normal flood plain of a stream, subject to flooding.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Catena. A sequence, or "chain," of soils on a landscape that formed in similar kinds of parent material but have different characteristics as a result of differences in relief and drainage.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity, but is more precise in meaning.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Climax vegetation. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse fragments. Mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter.

Coarse textured soil. Sand or loamy sand.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.5 to 25 centimeters) in diameter.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Compressible (in tables). Excessive decrease in volume of soft soil under load.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Conservation tillage. A tillage system that does not invert the soil and that leaves all or part of the crop residue on the surface throughout the year.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping (or contour farming). Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Deferred grazing. Postponing grazing or arresting grazing for a prescribed period.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically for long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially

drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay in the soil. The soil does not provide a source of gravel or sand for construction purposes.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fibric soil material (peat). The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fine textured soil. Sandy clay, silty clay, and clay.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Forb. Any herbaceous plant not a grass or a sedge.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Glacial drift (geology). Pulverized and other rock material transported by glacial ice and then deposited. Also the sorted and unsorted material deposited by streams flowing from glaciers.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by glacial melt water.

Glacial till (geology). Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Glaciofluvial deposits (geology). Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and occur as kames, eskers, deltas, and outwash plains.

Glaciolacustrine deposits. Material ranging from fine clay to sand derived from glaciers and deposited in glacial lakes mainly by glacial melt water. Many deposits are interbedded or laminated.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.5 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.5 centimeters) in diameter.

Green manure (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Hemic soil material (mucky peat). Organic soil material intermediate in degree of decomposition between

the less decomposed fibric and the more decomposed sapric material.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an upper case letter represents the major horizons. Numbers or lower case letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the *Soil Survey Manual.* The major horizons of mineral soil are as follows:

O horizon.—An organic layer of fresh and decaying plant residue at the surface of a mineral soil.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil does not have a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake in inches per hour is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Lacustrine deposit (geology). Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Large stones (in tables). Rock fragments 3 inches (7.5 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Miscellaneous areas. Areas that have little or no natural soil and support little or no vegetation.

Moderately coarse textured soil. Sandy loam and fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, and silty clay loam.

Moraine (geology). An accumulation of earth, stones, and other debris deposited by a glacier. Some types are terminal, lateral, medial, and ground.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Muck. Dark colored, finely divided, well decomposed organic soil material. (See Sapric soil material.)

Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Open space. A relatively undeveloped green or wooded area provided mainly within an urban area to minimize feelings of congested living.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Outwash, glacial. Stratified sand and gravel produced by glaciers and carried, sorted, and deposited by glacial melt water.

Outwash plain. A landform of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it is generally low in relief.

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan*.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Peat. Unconsolidated material, largely undecomposed organic matter, that has accumulated under excess moisture. (See Fibric soil material.)

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Percs slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.20 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Ponding. Standing water on soils in closed depressions. The water can be removed only by percolation or evapotranspiration.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Poor outlets (in tables). Refers to areas where surface or subsurface drainage outlets are difficult or expensive to install.

Productivity (soil). The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock.

Relief. The elevations or inequalities of a land surface, considered collectively.

Rill. A steep sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rippable. Bedrock or hardpan can be excavated using a single-tooth ripping attachment mounted on a tractor with a 200-300 draw bar horsepower rating.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-size particles.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and runoff water.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slow intake (in tables). The slow movement of water into the soil.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.5 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 mm in equivalent diameter and ranging between specified

size limits. The names and sizes of separates recognized in the United States are as follows:

	Millimeters
Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	Less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Tilling a soil below normal plow depth, ordinarily to shatter a hardpan or claypan.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A1, A2, or A3) below the surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A horizon. Includes all subdivisions of this horizon (A1, A2, or A3).

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terminal moraine. A belt of thick glacial drift that generally marks the termination of important glacial advances.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that it can soak into the soil or flow slowly to a prepared outlet without harm. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt, silt loam, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Till plain. An extensive flat to undulating area underlain by glacial till.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, are in soils in extremely small amounts. They are essential to plant growth.

Unstable fill (in tables). Risk of caving or sloughing on banks of fill material.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but occurring in such a limited geographic area that creation of a new series is not justified.

Varve. A sedimentary layer or a lamina or sequence of laminae deposited in a body of still water within a year. Specifically, a thin pair of graded glaciolacustrine layers seasonally deposited, usually by melt water streams, in a glacial lake or other body of still water in front of a glacier.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These

changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

[Recorded in the period 1948-1977 at Eau Claire]

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days[1]	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January----	31.1	17.0	24.1	57	-10	0	2.31	1.4	3.1	7	17.5
February---	34.5	19.9	27.2	57	-7	0	1.79	1.0	2.5	6	12.7
March------	44.4	27.5	36.0	74	6	18	2.57	1.6	3.5	7	7.2
April------	59.0	38.3	48.7	82	20	111	3.80	2.3	5.2	8	2.2
May--------	70.3	48.1	59.2	89	30	314	3.30	2.0	4.5	6	T[2]
June-------	79.8	58.2	69.0	94	40	577	3.45	2.1	4.6	7	0
July-------	83.4	62.2	72.8	96	48	715	3.33	1.9	4.6	6	0
August-----	81.7	60.6	71.2	95	45	664	2.86	1.4	4.1	6	0
September--	74.5	53.8	64.1	93	35	434	3.40	1.5	5.0	6	T
October----	63.6	44.1	53.8	85	25	186	2.97	1.4	4.4	6	.8
November---	47.6	32.9	40.2	73	9	31	2.82	2.0	3.5	8	8.1
December---	35.3	22.5	28.9	61	-1	0	2.78	1.7	3.7	8	16.5
Year-----	58.8	40.4	49.6	97	-11	3,050	35.38	30.8	39.8	80	65.0

[1] A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (50° F).

[2] Trace.

TABLE 2.--TEMPERATURE AND PRECIPITATION

[Recorded in the period 1948-1977 at Benton Harbor]

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days[1]	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Snowfall
	^{o}F	^{o}F	^{o}F	^{o}F	^{o}F	Units	In	In	In		In
January----	32.3	18.3	25.3	58	-8	0	3.04	1.9	4.1	9	20.7
February---	35.3	20.5	27.9	58	-5	0	2.11	1.1	3.0	7	14.0
March------	44.4	27.6	36.0	74	4	17	2.66	1.4	3.8	7	7.7
April------	58.2	37.6	47.9	83	19	100	3.82	2.1	5.4	8	1.6
May--------	68.9	46.8	57.9	89	29	281	3.17	1.9	4.3	7	0
June-------	78.8	57.0	67.9	94	39	544	3.53	2.0	4.9	7	0
July-------	82.1	61.3	71.7	94	45	681	3.01	1.8	4.1	5	0
August-----	80.7	59.2	70.0	94	42	627	2.82	1.3	4.2	6	0
September--	74.5	53.0	63.7	92	32	423	3.22	1.4	4.8	6	0
October----	64.0	43.5	53.7	84	25	179	2.99	1.2	4.5	6	.4
November---	48.7	33.3	41.0	73	9	29	2.90	2.1	3.7	8	6.2
December---	36.6	23.3	30.0	61	-1	0	3.24	1.9	4.4	9	17.9
Year-----	58.7	40.1	49.4	96	-10	2,880	36.52	30.9	41.9	82	68.4

[1]A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (50° F).

TABLE 3.--FREEZE DATES IN SPRING AND FALL

[Recorded in the period 1948-1977 at Eau Claire]

Probability	Temperature 24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	April 19	April 30	May 15
2 years in 10 later than--	April 13	April 25	May 10
5 years in 10 later than--	April 3	April 17	May 2
First freezing temperature in fall:			
1 year in 10 earlier than--	October 29	October 19	October 5
2 years in 10 earlier than--	November 3	October 24	October 11
5 years in 10 earlier than--	November 14	November 3	October 21

TABLE 4.--GROWING SEASON

[Recorded in the period 1948-1977 at Eau Claire]

Probability	Daily minimum temperature during growing season		
	Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
9 years in 10	200	179	152
8 years in 10	208	186	159
5 years in 10	224	199	171
2 years in 10	240	212	183
1 year in 10	248	219	189

TABLE 5.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
2	Cohoctah-Abscota sandy loams	1,855	0.5
3	Beaches	370	0.1
4	Dune land	740	0.2
5	Houghton muck	8,160	2.3
6	Adrian muck	740	0.2
7	Palms muck	1,855	0.5
10B	Oakville fine sand, 0 to 6 percent slopes	6,680	1.8
10D	Oakville fine sand, 6 to 18 percent slopes	3,300	0.9
10F	Oakville fine sand, 18 to 45 percent slopes	3,710	1.0
11B	Oshtemo sandy loam, 0 to 6 percent slopes	21,145	5.7
11C	Oshtemo sandy loam, 6 to 12 percent slopes	6,680	1.8
11D	Oshtemo sandy loam, 12 to 18 percent slopes	4,080	1.1
11E	Oshtemo sandy loam, 18 to 35 percent slopes	4,825	1.3
12A	Ockley loam, 0 to 2 percent slopes	4,080	1.1
12B	Ockley loam, 2 to 6 percent slopes	8,160	2.2
12C	Ockley loam, 6 to 12 percent slopes	2,595	0.7
12D	Ockley loam, 12 to 18 percent slopes	1,855	0.5
13B	Spinks loamy fine sand, 0 to 6 percent slopes	23,000	6.2
13C	Spinks loamy fine sand, 6 to 12 percent slopes	5,195	1.3
13D	Spinks loamy fine sand, 12 to 18 percent slopes	2,970	0.8
14B	Riddles loam, 2 to 6 percent slopes	11,500	3.0
14C	Riddles loam, 6 to 12 percent slopes	7,000	1.8
14D	Riddles loam, 12 to 18 percent slopes	2,600	0.7
14E	Riddles loam, 18 to 45 percent slopes	1,115	0.3
15C	Glynwood loam, 6 to 12 percent slopes	1,485	0.4
16B	Crosier silt loam, 0 to 4 percent slopes	14,470	3.9
17	Rensselaer silt loam	4,405	1.1
19A	Brady sandy loam, 0 to 2 percent slopes	11,130	3.0
20	Gilford sandy loam	6,680	1.8
22A	Monitor loam, 0 to 3 percent slopes	4,080	1.1
23	Sebewa loam	3,710	1.0
25	Lenawee silty clay loam	1,115	0.3
26A	Pipestone sand, 0 to 2 percent slopes	1,485	0.4
27B	Tustin loamy fine sand, 2 to 6 percent slopes	740	0.2
27C	Tustin loamy fine sand, 6 to 12 percent slopes	370	0.1
28B	Rimer loamy fine sand, 0 to 4 percent slopes	15,955	4.2
29	Cohoctah sandy loam	9,645	2.6
30	Belleville loamy fine sand	2,225	0.6
31A	Kibbie loam, 0 to 3 percent slopes	7,790	2.1
32	Pella silt loam	7,420	2.0
33D	Morley silt loam, 12 to 18 percent slopes	370	0.1
33E	Morley silt loam, 18 to 25 percent slopes	370	0.1
34B	Blount loam, 0 to 4 percent slopes	28,940	7.7
35	Aquents and Histosols, ponded	3,340	0.9
36	Pewamo silt loam	4,080	1.1
37	Granby loamy fine sand	4,825	1.3
38	Elvers silt loam	740	0.2
42A	Morocco loamy sand, 0 to 2 percent slopes	7,050	1.9
44A	Coupee silt loam, 0 to 3 percent slopes	1,485	0.4
51	Houghton-Kerston mucks	1,855	0.5
52B	Abscota sandy loam, 0 to 6 percent slopes	740	0.2
55	Edwards muck	2,225	0.6
56B	Martinsville fine sandy loam, 2 to 6 percent slopes	1,485	0.4
56C	Martinsville fine sandy loam, 6 to 12 percent slopes	740	0.2
57A	Thetford loamy sand, 0 to 2 percent slopes	10,190	2.7
60B	Plainfield sand, 0 to 6 percent slopes	5,195	1.4
61A	Whitaker loam, 0 to 2 percent slopes	2,025	0.5
62	Poy silt loam	1,115	0.3
63B	Metea loamy sand, 1 to 6 percent slopes	3,500	0.9
63C	Metea loamy sand, 6 to 12 percent slopes	1,115	0.3
64A	Selfridge loamy sand, 0 to 3 percent slopes	5,565	1.5
65F	Udorthents and Udipsamments, 18 to 90 percent slopes	5,835	1.6
66A	Landes Variant silt loam, 0 to 3 percent slopes	370	0.1
67A	Shoals silt loam, 0 to 2 percent slopes	2,225	0.6
68A	Granby-Morocco complex, 0 to 3 percent slopes	1,115	0.3
69B	Plainfield-Urban land complex, 0 to 6 percent slopes	7,000	1.9
70A	Thetford-Urban land complex, 0 to 3 percent slopes	2,225	0.6
71	Pits	1,485	0.4
72B	Udipsamments and Udorthents, 0 to 6 percent slopes	2,225	0.6
75B	Rimer-Urban land complex, 0 to 4 percent slopes	1,115	0.3
76	Urban land	1,115	0.3
77B	Oshtemo-Urban land complex, 0 to 6 percent slopes	6,305	1.7

TABLE 5.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Map symbol	Soil name	Acres	Percent
78B	Riddles-Oshtemo complex, 1 to 6 percent slopes	11,760	3.0
78C	Riddles-Oshtemo complex, 6 to 12 percent slopes	5,935	1.6
78D	Riddles-Oshtemo complex, 12 to 18 percent slopes	3,710	1.0
80	Cohoctah-Urban land complex	1,115	0.3
82B	Oshtemo-Ockley complex, 0 to 4 percent slopes	3,610	1.0
	Water	2,750	0.7
	Total	373,760	100.0

TABLE 6.--YIELDS PER ACRE OF FIELD CROPS

[Yields in the N columns are for nonirrigated soils; those in the I columns are for irrigated soils. Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil]

Soil name and map symbol	Corn		Corn silage		Oats		Winter wheat		Soybeans		Grass-legume hay	
	N	I	N	I	N	I	N	I	N	I	N	I
	Bu	Bu	Ton	Ton	Bu	Bu	Bu	Bu	Bu	Bu	Ton	Ton
2. Cohoctah-Abscota	---	---	---	---	---	---	---	---	---	---	---	---
3*. Beaches												
4*. Dune land												
5. Houghton	115	160	20	26	---	---	---	---	34	47	---	---
6. Adrian	75	160	10	24	---	---	---	---	23	47	---	---
7. Palms	105	160	17	26	65	---	---	---	42	47	---	---
10B. Oakville	50	160	8	25	48	---	24	---	---	---	2.0	6.5
10D. Oakville	---	---	---	---	35	---	---	---	---	---	1.8	---
10F. Oakville	---	---	---	---	---	---	---	---	---	---	---	---
11B. Oshtemo	90	170	13	25	60	---	35	---	30	57	2.5	7.2
11C. Oshtemo	85	160	12	23	55	---	32	---	26	49	2.5	6.8
11D. Oshtemo	75	---	11	---	50	---	27	---	21	---	2.2	5.8
11E. Oshtemo	---	---	---	---	---	---	---	---	---	---	1.5	---
12A. Ockley	110	175	16	27	85	---	60	---	38	61	3.6	8.0
12B. Ockley	110	175	16	27	85	---	60	---	38	61	3.6	8.0
12C. Ockley	100	160	15	25	80	---	56	---	35	56	3.3	7.5
12D. Ockley	85	---	12	---	---	---	34	---	30	---	2.8	---
13B. Spinks	75	170	13	25	60	---	30	---	27	56	3.0	7.0
13C. Spinks	66	150	11	22	55	---	30	---	23	49	2.4	6.6
13D. Spinks	---	---	---	---	50	---	24	---	---	---	1.8	---
14B. Riddles	115	175	18	27	90	---	60	---	40	61	3.8	8.0

See footnote at end of table.

TABLE 6.--YIELDS PER ACRE OF FIELD CROPS--Continued

Soil name and map symbol	Corn N	Corn I	Corn silage N	Corn silage I	Oats N	Oats I	Winter wheat N	Winter wheat I	Soybeans N	Soybeans I	Grass-legume hay N	Grass-legume hay I
	Bu	Bu	Ton	Ton	Bu	Bu	Bu	Bu	Bu	Bu	Ton	Ton
14C: Riddles	105	160	17	25	85	---	56	---	37	61	3.4	7.5
14D: Riddles	90	---	15	---	80	---	50	---	32	---	3.0	---
14E: Riddles	---	---	---	---	---	---	---	---	---	---	---	---
15C: Glynwood	115	165	18	---	90	---	55	---	40	55	4.3	8.0
16B: Crosier	120	175	18	27	100	---	65	---	42	61	4.0	8.0
17: Rensselaer	130	175	20	27	110	---	60	---	53	61	5.0	8.0
19A: Brady	80	170	12	25	60	---	35	---	30	53	3.0	7.2
20: Gilford	120	170	20	25	75	---	54	---	32	53	4.0	7.2
22A: Monitor	125	175	17	27	90	---	50	---	33	61	4.1	8.0
23: Sebewa	130	175	17	27	90	---	50	---	36	61	4.6	8.0
25: Lenawee	125	185	19	26	100	---	60	---	42	55	4.0	7.0
26A: Pipestone	60	160	12	24	60	---	30	---	---	---	3.0	6.5
27B: Tustin	95	165	12	26	80	---	55	---	35	55	4.0	7.2
27C: Tustin	85	150	11	25	75	---	50	---	31	48	3.5	6.9
28B: Rimer	115	165	18	26	95	---	60	---	38	55	4.0	7.2
29: Cohoctah	---	---	---	---	---	---	---	---	---	---	3.5	---
30: Belleville	105	165	17	25	85	---	50	---	35	52	4.2	7.2
31A: Kibbie	110	175	18	27	90	---	65	---	40	61	4.0	8.0
32: Pella	125	175	20	27	110	---	65	---	45	61	4.8	8.0
33D: Morley	105	---	17	---	85	---	55	---	---	---	3.7	8.0
33E: Morley	---	---	---	---	---	---	---	---	---	---	3.1	---
34B: Blount	115	165	18	26	90	---	47	---	35	55	4.3	8.0
35: Aquents and Histosols	---	---	---	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 6.--YIELDS PER ACRE OF FIELD CROPS--Continued

Soil name and map symbol	Corn N	Corn I	Corn silage N	Corn silage I	Oats N	Oats I	Winter wheat N	Winter wheat I	Soybeans N	Soybeans I	Grass-legume hay N	Grass-legume hay I
	Bu	Bu	Ton	Ton	Bu	Bu	Bu	Bu	Bu	Bu	Ton	Ton
36 Pewamo	125	165	19	26	100	---	60	---	42	55	5.0	8.6
37 Granby	75	160	10	24	55	---	35	---	30	46	3.5	6.5
38 Elvers	130	165	19	27	110	---	65	---	45	61	4.0	8.0
42A Morocco	60	160	11	24	55	---	30	---	28	---	2.6	---
44A Coupee	95	175	16	27	85	---	48	---	33	61	3.1	8.0
51 Houghton-Kerston	107	160	18	25	---	---	---	---	34	55	---	---
52B Abscota	70	160	13	25	60	---	28	---	25	49	3.0	7.0
55 Edwards	90	160	15	25	---	---	---	---	34	---	---	---
56B Martinsville	115	175	17	27	90	---	60	---	40	61	3.8	8.0
56C Martinsville	105	160	16	25	85	---	53	---	35	56	3.5	7.5
57A Thetford	60	170	10	25	60	---	35	---	30	49	3.0	7.0
60B Plainfield	40	120	8	24	35	---	20	---	---	---	2.0	6.5
61A Whitaker	125	175	20	27	110	---	65	---	44	61	4.1	8.0
62 Poy	110	165	17	25	95	---	53	---	35	56	4.5	7.2
63B Metea	95	165	15	25	75	---	42	---	30	52	4.0	7.2
63C Metea	85	150	13	24	68	---	38	---	26	45	3.5	6.5
64A Selfridge	90	165	14	25	80	---	42	---	33	52	3.2	7.2
65F Udorthents and Udipsamments	---	---	---	---	---	---	---	---	---	---	---	---
66A Landes Variant	110	175	17	27	90	143	60	95	35	56	4.8	8.0
67A Shoals	120	175	18	26	100	---	65	---	40	58	4.5	8.0
68A Granby-Morocco	77	160	10	24	50	---	35	---	20	40	3.5	6.5
69B Plainfield-Urban land	---	---	---	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 6.--YIELDS PER ACRE OF FIELD CROPS--Continued

Soil name and map symbol	Corn		Corn silage		Oats		Winter wheat		Soybeans		Grass-legume hay	
	N	I	N	I	N	I	N	I	N	I	N	I
	Bu	Bu	Ton	Ton	Bu	Bu	Bu	Bu	Bu	Bu	Ton	Ton
70A------------------------ Thetford-Urban land	---	---	---	---	---	---	---	---	---	---	---	---
71*. Pits												
72B------------------------ Udipsamments and Udorthents	---	---	---	---	---	---	---	---	---	---	---	---
75B------------------------ Rimer-Urban land	---	---	---	---	---	---	---	---	---	---	---	---
76*. Urban land												
77B------------------------ Oshtemo-Urban land	---	---	---	---	---	---	---	---	---	---	---	---
78B------------------------ Riddles-Oshtemo	100	170	16	26	78	---	50	---	36	55	3.7	7.2
78C------------------------ Riddles-Oshtemo	92	159	14	25	73	---	46	---	32	48	3.4	6.8
78D------------------------ Riddles-Oshtemo	79	---	12	---	67	---	42	---	27	---	3.0	---
80------------------------- Cohoctah-Urban land	---	---	---	---	---	---	---	---	---	---	---	---
82B------------------------ Oshtemo-Ockley	92	170	14	25	70	---	39	---	33	56	3.5	7.2

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--YIELDS PER ACRE OF SPECIALTY CROPS

[Yields in the N columns are for nonirrigated soils; those in the I columns are for irrigated soils. Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil]

Soil name and map symbol	Apples		Blueberries		Cherries		Peaches		Tomatoes		Strawberries	
	N	I	N	I	N	I	N	I	N	I	N	I
	Bu	Bu	Lb	Lb	Ton	Ton	Bu	Bu	Ton	Ton	Crate	Crate
2----- Cohoctah-Abscota	---	---	---	---	---	---	---	---	---	---	---	---
3*. Beaches												
4*. Dune land												
5----- Houghton	---	---	---	8,000	---	---	---	---	---	---	---	---
6----- Adrian	---	---	---	8,000	---	---	---	---	---	---	---	---
7----- Palms	---	---	---	8,000	---	---	---	---	---	---	---	---
10B----- Oakville	---	---	---	---	4	5	300	350	11	15	---	550
10D----- Oakville	---	---	---	---	---	---	300	350	---	---	---	---
10F----- Oakville	---	---	---	---	---	---	---	---	---	---	---	---
11B----- Oshtemo	550	---	---	---	4	5	300	350	20	24	---	550
11C----- Oshtemo	550	---	---	---	4	5	300	350	20	24	---	550
11D----- Oshtemo	550	---	---	---	---	---	300	350	---	---	---	---
11E----- Oshtemo	---	---	---	---	---	---	---	---	---	---	---	---
12A----- Ockley	550	---	---	---	4	5	300	350	20	24	---	550
12B----- Ockley	550	---	---	---	4	5	300	350	20	24	---	550
12C----- Ockley	550	---	---	---	4	5	300	350	20	24	---	550
12D----- Ockley	550	---	---	---	---	---	300	350	---	---	---	---
13B----- Spinks	550	---	---	---	4	5	300	350	16	20	---	550
13C----- Spinks	550	---	---	---	4	5	300	350	16	20	---	550
13D----- Spinks	550	---	---	---	---	---	300	350	---	---	---	---
14B----- Riddles	550	---	---	---	4	5	300	350	20	24	---	550

See footnote at end of table.

TABLE 7.--YIELDS PER ACRE OF SPECIALTY CROPS--Continued

Soil name and map symbol	Apples		Blueberries		Cherries		Peaches		Tomatoes		Strawberries	
	N	I	N	I	N	I	N	I	N	I	N	I
	Bu	Bu	Lb	Lb	Ton	Ton	Bu	Bu	Ton	Ton	Crate	Crate
14C: Riddles	550	---	---	---	4	5	300	350	20	24	---	550
14D: Riddles	550	---	---	---	4	5	300	350	---	---	---	---
14E: Riddles	---	---	---	---	---	---	---	---	---	---	---	---
15C: Glynwood	550	---	---	---	---	---	---	---	---	---	---	---
16B: Crosier	550	---	---	---	---	---	---	---	20	24	---	---
17: Rensselaer	---	---	---	---	---	---	---	---	18	20	---	---
19A: Brady	350	---	---	5,000	---	---	---	---	20	24	---	---
20: Gilford	---	---	---	6,000	---	---	---	---	17	20	---	---
22A: Monitor	450	---	---	---	---	---	---	---	20	24	---	---
23: Sebewa	---	---	---	---	---	---	---	---	18	20	---	---
25: Lenawee	---	---	---	---	---	---	---	---	---	---	---	---
26A: Pipestone	350	---	---	6,000	---	---	---	---	11	15	---	---
27B: Tustin	550	---	---	---	4	5	300	350	20	24	---	550
27C: Tustin	550	---	---	---	4	5	300	350	16	20	---	550
28B: Rimer	400	---	---	5,000	---	---	---	---	16	20	---	---
29: Cohoctah	---	---	---	---	---	---	---	---	---	---	---	---
30: Belleville	---	---	---	6,000	---	---	---	---	18	20	---	---
31A: Kibbie	550	---	---	---	---	---	---	---	18	22	---	---
32: Pella	---	---	---	---	---	---	---	---	18	20	---	---
33D: Morley	550	---	---	---	---	---	300	350	---	---	---	---
33E: Morley	---	---	---	---	---	---	---	---	---	---	---	---
34B: Blount	450	---	---	---	---	---	---	---	---	---	---	---
35: Aquents and Histosols	---	---	---	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 7.--YIELDS PER ACRE OF SPECIALTY CROPS--Continued

Soil name and map symbol	Apples		Blueberries		Cherries		Peaches		Tomatoes		Strawberries	
	N	I	N	I	N	I	N	I	N	I	N	I
	Bu	Bu	Lb	Lb	Ton	Ton	Bu	Bu	Ton	Ton	Crate	Crate
36----------------------- Pewamo	---	---	---	---	---	---	---	---	---	---	---	---
37----------------------- Granby	---	---	---	6,000	---	---	---	---	18	20	---	---
38----------------------- Elvers	---	---	---	6,000	---	---	---	---	20	24	---	---
42A---------------------- Morocco	350	---	---	5,000	---	---	---	---	16	20	---	---
44A---------------------- Coupee	550	---	---	---	4	5	300	350	20	24	---	550
51----------------------- Houghton-Kerston	---	---	---	8,000	---	---	---	---	---	---	---	---
52B---------------------- Abscota	---	---	---	---	---	---	---	---	16	20	---	---
55----------------------- Edwards	---	---	---	---	---	---	---	---	---	---	---	---
56B---------------------- Martinsville	550	---	---	---	4	5	300	350	20	24	---	550
56C---------------------- Martinsville	550	---	---	---	4	5	300	350	20	24	---	550
57A---------------------- Thetford	350	---	---	5,000	---	---	---	---	20	24	---	---
60B---------------------- Plainfield	---	---	---	---	---	---	300	350	11	15	---	550
61A---------------------- Whitaker	450	---	---	---	---	---	---	---	18	22	---	---
62----------------------- Poy	---	---	---	---	---	---	---	---	20	22	---	---
63B---------------------- Metea	550	---	---	---	4	5	300	350	20	24	---	550
63C---------------------- Metea	550	---	---	---	4	5	300	350	20	24	---	550
64A---------------------- Selfridge	400	---	---	5,000	---	---	---	---	16	20	---	---
65F---------------------- Udorthents and Udipsamments	---	---	---	---	---	---	---	---	---	---	---	---
66A---------------------- Landes Variant	---	---	---	---	---	---	---	---	18	20	---	---
67A---------------------- Shoals	---	---	---	---	---	---	---	---	18	20	---	---
68A---------------------- Granby-Morocco	---	---	---	6,000	---	---	---	---	16	20	---	---
69B---------------------- Plainfield-Urban land	---	---	---	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 7.--YIELDS PER ACRE OF SPECIALTY CROPS--Continued

Soil name and map symbol	Apples		Blueberries		Cherries		Peaches		Tomatoes		Strawberries	
	N	I	N	I	N	I	N	I	N	I	N	I
	Bu	Bu	Lb	Lb	Ton	Ton	Bu	Bu	Ton	Ton	Crate	Crate
70A: Thetford-Urban land	---	---	---	---	---	---	---	---	---	---	---	---
71*. Pits												
72B: Udipsamments and Udorthents	---	---	---	---	---	---	---	---	---	---	---	---
75B: Rimer-Urban land	---	---	---	---	---	---	---	---	---	---	---	---
76*. Urban land												
77B: Oshtemo-Urban land	---	---	---	---	---	---	---	---	---	---	---	---
78B: Riddles-Oshtemo	550	---	---	---	4	5	300	350	20	24	---	550
78C: Riddles-Oshtemo	550	---	---	---	4	5	300	350	20	24	---	550
78D: Riddles-Oshtemo	550	---	---	---	---	---	300	350	---	---	---	---
80: Cohoctah-Urban land	---	---	---	---	---	---	---	---	---	---	---	---
82B: Oshtemo-Ockley	550	---	---	---	4	5	300	350	20	24	---	550

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--CAPABILITY CLASSES AND SUBCLASSES

[Miscellaneous areas are excluded. Absence of an entry indicates no acreage]

Class	Total acreage	Major management concerns (Subclass)		
		Erosion (e)	Wetness (w)	Soil problem (s)
		Acres	Acres	Acres
I	4,450	---	---	---
II	153,610	32,905	119,220	1,485
III	124,465	38,595	41,725	44,145
IV	33,020	15,955	4,450	12,615
V	12,615	---	12,615	---
VI	9,610	6,310	---	3,300
VII	9,545	5,835	---	3,710
VIII	4,450	---	3,340	1,110

TABLE 9.--WOODLAND MANAGEMENT AND PRODUCTIVITY

[Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that information was not available]

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Common trees	Potential productivity: Site index	Trees to plant
2*:								
Cohoctah	3w	Slight	Severe	Severe	Moderate	Red maple	56	Eastern cottonwood, American sycamore, red maple, swamp white oak, pin oak.
						Eastern cottonwood	91	
						Silver maple	82	
						White ash	66	
						Swamp white oak	---	
						American sycamore	---	
						Pin oak	---	
						Bitternut hickory	---	
Abscota	2s	Slight	Slight	Moderate	Slight	Northern red oak	66	Eastern cottonwood, eastern white pine, American sycamore.
						White ash	---	
						Silver maple	---	
						Eastern cottonwood	---	
						American sycamore	---	
5 Houghton	3w	Slight	Severe	Severe	Severe	Red maple	56	
						Silver maple	82	
						White ash	56	
						Quaking aspen	60	
						Tamarack	45	
						Green ash	---	
						Northern white-cedar	27	
						Swamp white oak	---	
6 Adrian	3w	Slight	Severe	Severe	Severe	Red maple	56	
						Silver maple	82	
						White ash	56	
						Quaking aspen	60	
						Tamarack	45	
						Green ash	56	
7 Palms	3w	Slight	Severe	Severe	Severe	Red maple	55	
						Silver maple	76	
						White ash	51	
						Quaking aspen	56	
						Northern white-cedar	27	
						Tamarack	45	
						Black ash	---	
10B, 10D Oakville	2s	Slight	Slight	Severe	Slight	Northern red oak	66	Red pine, eastern white pine, jack pine, Norway spruce, black spruce, black cherry.
						White oak	66	
						Red pine	65	
						Quaking aspen	70	
						Black oak	66	
						Eastern white pine	65	
10F Oakville	2s	Moderate	Moderate	Severe	Slight	Northern red oak	66	Red pine, eastern white pine, jack pine, Norway spruce, black spruce, black cherry.
						White oak	66	
						Red pine	65	
						Quaking aspen	70	
						Black oak	66	
						Eastern white pine	65	
11B, 11C, 11D Oshtemo	2o	Slight	Slight	Slight	Slight	Northern red oak	66	Eastern white pine, red pine, white spruce, jack pine.
						White oak	---	
						American basswood	66	
						Sugar maple	61	
11E Oshtemo	2r	Moderate	Moderate	Slight	Slight	Northern red oak	66	Eastern white pine, red pine, white spruce, jack pine.
						White oak	---	
						American basswood	66	
						Sugar maple	61	

See footnote at end of table.

TABLE 9.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Common trees	Potential productivity: Site index	Trees to plant
12A, 12B, 12C, 12D--Ockley	1o	Slight	Slight	Slight	Slight	White oak----------- Northern red oak---- Yellow-poplar-------	90 90 98	Eastern white pine, red pine, white ash, yellow-poplar, black walnut.
13B, 13C, 13D------Spinks	2s	Slight	Slight	Moderate	Slight	Northern red oak---- White oak----------- Shagbark hickory---- Black oak----------- Black cherry--------	66 66 66 66 66	Red pine, eastern white pine, jack pine, black cherry.
14B, 14C, 14D------Riddles	2o	Slight	Slight	Slight	Slight	Northern red oak---- Red maple----------- White ash----------- Green ash----------- Black walnut-------- Yellow-poplar-------	66 66 66 66 --- ---	Black walnut, eastern cottonwood, red pine, white spruce.
14E----------------Riddles	2r	Moderate	Moderate	Slight	Slight	Northern red oak---- Red maple----------- White ash----------- Green ash----------- Black walnut-------- Yellow-poplar-------	66 66 66 66 --- ---	Black walnut, eastern cottonwood, red pine, white spruce.
15C----------------Glynwood	3c	Slight	Slight	Moderate	Moderate	Northern red oak---- White ash----------- Red maple----------- Pin oak------------- Swamp white oak----- American beech------	55 55 55 --- --- ---	White ash, red maple, yellow-poplar.
16B----------------Crosier	3o	Slight	Slight	Slight	Slight	Northern red oak---- White oak----------- American basswood--- White ash-----------	55 --- --- ---	White spruce, eastern white pine.
17-----------------Rensselaer	2w	Slight	Severe	Severe	Severe	Pin oak------------- White oak----------- Northern red oak----	86 75 76	Eastern white pine, Norway spruce, red maple, white ash.
19A----------------Brady	3o	Slight	Slight	Slight	Slight	Red maple----------- White ash----------- Quaking aspen------- Silver maple-------- Bitternut hickory--- Swamp white oak----- American basswood---	56 56 60 82 --- --- 56	White spruce, eastern white pine, Norway spruce, Austrian pine, American sycamore, red maple.
20-----------------Gilford	5w	Slight	Severe	Severe	Moderate	Silver maple-------- American basswood--- Pin oak------------- Red maple----------- White ash----------- Swamp white oak----- Bur oak-------------	65 --- --- --- --- --- ---	Eastern white pine, silver maple, Norway spruce, white spruce, European larch, eastern cottonwood.
22A----------------Monitor	---	--------	--------	--------	--------	---	---	Eastern white pine, white ash, red maple, yellow-poplar, American sycamore.
23-----------------Sebewa	2w	Slight	Severe	Moderate	Moderate	Red maple----------- White ash----------- American basswood--- Swamp white oak----- Pin oak------------- Northern red oak----	66 66 --- --- 66 66	White spruce, eastern white pine, Norway spruce, white ash.

See footnote at end of table.

TABLE 9.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Common trees	Potential productivity: Site index	Trees to plant
25, Lenawee	3w	Slight	Severe	Severe	Moderate	Red maple	66	White spruce, Norway spruce, eastern white pine.
						White ash	66	
						American basswood	66	
						Silver maple	81	
26A, Pipestone	3s	Slight	Slight	Severe	Slight	Red maple	56	White spruce, eastern cottonwood, eastern white pine, Norway spruce, Austrian pine.
						White ash	56	
						Eastern cottonwood	91	
						Bitternut hickory	---	
						Common hackberry	---	
						American basswood	56	
27B, 27C, Tustin	3s	Slight	Slight	Moderate	Slight	Black oak	55	Red pine, eastern white pine, Norway spruce.
						Red pine	---	
						Eastern white pine	---	
						Northern red oak	---	
28B, Rimer	3s	Slight	Slight	Moderate	Slight	Northern red oak	55	White spruce, eastern white pine, northern white-cedar.
						White oak	---	
						Red maple	---	
29, Cohoctah	3w	Slight	Severe	Severe	Severe	Red maple	56	Eastern cottonwood, American sycamore, Austrian pine, Carolina poplar, red maple, swamp white oak, pin oak.
						Eastern cottonwood	91	
						Silver maple	82	
						White ash	66	
						Swamp white oak	---	
						American sycamore	---	
						Pin oak	---	
						Bitternut hickory	---	
30, Belleville	5w	Slight	Severe	Moderate	Moderate	Silver maple	64	Black spruce, white spruce.
						Red maple	39	
						Tamarack	34	
						Pin oak	---	
						Swamp white oak	---	
31A, Kibbie	2o	Slight	Slight	Slight	Slight	Northern red oak	66	White spruce, eastern white pine, eastern cottonwood, white ash, Norway spruce.
						White oak	---	
						White ash	66	
						American basswood	66	
						Quaking aspen	70	
						Pin oak	---	
						Sugar maple	---	
32, Pella	4w	Slight	Severe	Moderate	Moderate	Northern white-cedar	15	Northern white-cedar, white spruce, tamarack, black spruce, pin oak, green ash.
						American elm	---	
						White ash	---	
						Silver maple	---	
33D, 33E, Morley	2r	Moderate	Moderate	Moderate	Slight	Northern red oak	55	Eastern white pine, red maple, white ash, yellow-poplar.
						Pin oak	---	
						Swamp white oak	---	
						White ash	55	
34B, Blount	3c	Slight	Slight	Moderate	Slight	Northern red oak	57	Eastern white pine, northern white-cedar, white spruce, Norway spruce, yellow-poplar.
						White oak	57	
						White ash	57	
						Sugar maple	54	
36, Pewamo	2w	Slight	Severe	Moderate	Moderate	Red maple	66	Eastern cottonwood, black spruce, white ash, eastern white pine, white spruce, Norway spruce, red maple.
						American basswood	66	
						Pin oak	85	
						Silver maple	91	
						Bur oak	---	
						Bitternut hickory	---	
						Black ash	---	
						Eastern cottonwood	---	

See footnote at end of table.

TABLE 9.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Common trees	Potential productivity: Site index	Trees to plant
37------------------ Granby	5w	Slight	Severe	Severe	Moderate	Red maple-----------	40	Eastern white pine, Norway spruce, white spruce, European larch.
						Silver maple--------	65	
						American basswood---	40	
						Pin oak-------------	---	
						Quaking aspen-------	45	
						Eastern cottonwood--	75	
						White ash-----------	40	
38------------------ Elvers	5w	Slight	Severe	Severe	Severe	Eastern cottonwood--	75	Eastern cottonwood, silver maple, white ash, white spruce.
						Silver maple--------	---	
						White ash-----------	---	
42A----------------- Morocco	3s	Slight	Slight	Moderate	Slight	Northern red oak----	70	Eastern white pine, European larch, red maple, American sycamore.
						Pin oak-------------	85	
						Eastern white pine--	65	
51*:								
Houghton-----------	3w	Slight	Severe	Severe	Severe	Red maple-----------	56	
						Silver maple--------	82	
						White ash-----------	56	
						Quaking aspen-------	60	
						Tamarack------------	45	
						Green ash-----------	---	
						Northern white-cedar	27	
						Swamp white oak-----	---	
Kerston------------	3w	Slight	Severe	Severe	Severe	Red maple-----------	51	
						White ash-----------	51	
						Green ash-----------	51	
						Silver maple--------	78	
						Tamarack------------	45	
						Black ash-----------	---	
						American basswood---	51	
52B----------------- Abscota	2s	Slight	Slight	Moderate	Slight	Northern red oak----	66	Eastern cottonwood, eastern white pine, American sycamore.
						White ash-----------	---	
						Silver maple--------	---	
						Eastern cottonwood--	---	
						American sycamore---	---	
55------------------ Edwards	3w	Slight	Severe	Severe	Severe	Red maple-----------	56	
						White ash-----------	56	
						Green ash-----------	56	
						Black cherry--------	---	
						Swamp white oak-----	---	
						Silver maple--------	82	
						Tamarack------------	45	
56B, 56C----------- Martinsville	1o	Slight	Slight	Slight	Slight	White oak-----------	90	Eastern white pine, red pine, white ash, yellow-poplar, black walnut.
						Yellow-poplar-------	98	
						Sweetgum------------	76	
57A----------------- Thetford	3s	Slight	Slight	Moderate	Slight	Red maple-----------	56	White spruce, Norway spruce, eastern white pine.
						White ash-----------	56	
						Quaking aspen-------	60	
						Eastern cottonwood--	91	
						Sugar maple---------	53	
						Northern red oak----	56	
						Swamp white oak-----	---	
						Bitternut hickory---	---	
60B----------------- Plainfield	3s	Slight	Slight	Severe	Slight	Red pine------------	55	Red pine, eastern white pine, jack pine.
						Eastern white pine--	---	
						Jack pine-----------	---	
						Northern pin oak----	---	

See footnote at end of table.

TABLE 9.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Common trees	Potential productivity: Site index	Trees to plant
61A----------------- Whitaker	3o	Slight	Slight	Slight	Slight	White oak-----------	70	Eastern white pine, baldcypress, white ash, red maple, yellow-poplar, American sycamore.
						Pin oak-------------	85	
						Yellow-poplar-------	85	
						Sweetgum------------	80	
						Northern red oak----	75	
62----------------- Poy	3w	Slight	Severe	Moderate	Moderate	Red maple-----------	55	Red maple, silver maple, white ash, green ash, white spruce.
						Swamp white oak-----	---	
						Northern red oak----	---	
						White ash-----------	55	
						Silver maple--------	---	
						American elm--------	---	
						Green ash-----------	---	
						American basswood---	---	
63B, 63C----------- Metea	2s	Slight	Slight	Moderate	Slight	Northern red oak----	66	Eastern white pine, red pine, white spruce, black walnut, European alder, Norway spruce.
						White oak-----------	---	
						Sugar maple---------	---	
						American basswood---	---	
						Black cherry--------	---	
						Black walnut--------	---	
						Shagbark hickory----	---	
64A----------------- Selfridge	3s	Slight	Slight	Moderate	Slight	Quaking aspen-------	60	Eastern white pine, Norway spruce, black cherry, Austrian pine.
						American beech------	---	
						Black oak-----------	---	
						Red maple-----------	---	
						Sugar maple---------	---	
						Black cherry--------	---	
						American basswood---	---	
66A----------------- Landes Variant	2o	Slight	Slight	Slight	Slight	Northern red oak----	65	Eastern white pine, red pine, black walnut, yellow-poplar, white ash.
						White ash-----------	---	
						Sugar maple---------	---	
						Red maple-----------	---	
						Black cherry--------	---	
						American basswood---	---	
67A----------------- Shoals	2o	Slight	Slight	Slight	Slight	Northern red oak----	66	Eastern white pine, white spruce, eastern cottonwood.
						Yellow-poplar-------	---	
						White ash-----------	---	
						Red maple-----------	---	
68A*:								
Granby------------	5w	Slight	Severe	Severe	Severe	Red maple-----------	40	Eastern white pine, Norway spruce, white spruce, European larch.
						Silver maple--------	65	
						American basswood---	40	
						Pin oak-------------	---	
						Quaking aspen-------	45	
						Eastern cottonwood--	75	
						White ash-----------	40	
Morocco-----------	3s	Slight	Slight	Moderate	Slight	Northern red oak----	70	Eastern white pine, European larch, red maple, American sycamore.
						Pin oak-------------	85	
						Eastern white pine--	65	
78B*, 78C*, 78D*:								
Riddles-----------	2o	Slight	Slight	Slight	Slight	Northern red oak----	66	Black walnut, eastern cottonwood, red pine, white spruce.
						Red maple-----------	66	
						White ash-----------	66	
						Green ash-----------	66	
						Black walnut--------	---	
						Yellow-poplar-------	---	
Oshtemo-----------	2o	Slight	Slight	Slight	Slight	Northern red oak----	66	Eastern white pine, red pine, white spruce, jack pine.
						White oak-----------	---	
						American basswood---	66	
						Sugar maple---------	61	

See footnote at end of table.

TABLE 9.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Common trees	Potential productivity: Site index	Trees to plant
82B*:								
Oshtemo------------	2o	Slight	Slight	Slight	Slight	Northern red oak---- White oak----------- American basswood--- Sugar maple---------	66 --- 66 61	Eastern white pine, red pine, white spruce, jack pine.
Ockley-------------	1o	Slight	Slight	Slight	Slight	White oak----------- Northern red oak---- Yellow-poplar------- Sweetgum------------	90 90 98 76	Eastern white pine, red pine, white ash, yellow-poplar, black walnut, black locust.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

[The symbol < means less than; > means more than. Absence of an entry indicates that trees generally do not grow to the given height on that soil]

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
2*: Cohoctah	Gray dogwood	Amur privet, silky dogwood, Austrian pine, Amur honeysuckle, redosier dogwood, silky dogwood.	Northern white-cedar, Siberian crabapple, white spruce.	---	Green ash, Carolina poplar.
Abscota	Silky dogwood	---	Black spruce, northern white-cedar.	Eastern white pine	Carolina poplar.
3*. Beaches					
4*. Dune land					
5 Houghton	Vanhoutte spirea	Silky dogwood, Amur privet, white spruce, redosier dogwood.	Eastern white pine, tamarack, Austrian pine.	Northern white-cedar, Norway spruce, Scotch pine.	Carolina poplar.
6 Adrian	---	Silky dogwood, white spruce.	Austrian pine	Northern white-cedar, Carolina poplar, Norway spruce, Scotch pine, eastern white pine.	---
7 Palms	Vanhoutte spirea	Silky dogwood, Tatarian honeysuckle, American cranberrybush, white spruce.	Eastern white pine, Austrian pine, tamarack.	Northern white-cedar, Norway spruce, Scotch pine.	Green ash.
10B, 10D, 10F Oakville	Vanhoutte spirea	Tatarian honeysuckle, autumn-olive, lilac, Amur privet, white spruce.	Red pine, American mountainash, Siberian crabapple.	Eastern white pine, jack pine, Scotch pine.	---
11B, 11C, 11D, 11E Oshtemo	Vanhoutte spirea, silky dogwood.	Autumn-olive, Tatarian honeysuckle, white spruce.	---	Eastern white pine, red pine, jack pine, Scotch pine.	Carolina poplar.
12A, 12B, 12C, 12D Ockley	---	Autumn olive, American cranberrybush, late lilac, Tatarian honey-suckle.	White spruce	Eastern white pine, Norway spruce.	Carolina poplar.
13B, 13C, 13D Spinks	Vanhoutte spirea	White spruce, Tatarian honeysuckle, Amur privet, autumn-olive.	Eastern redcedar	Eastern white pine, red pine.	---

See footnote at end of table.

TABLE 10.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of-- <8	8-15	16-25	26-35	>35
14B, 14C, 14D, 14E: Riddles	---	Autumn-olive	Northern white-cedar, red pine, white spruce.	Norway spruce, Scotch pine.	---
15C: Glynwood	---	White spruce, whitebelle honeysuckle, silky dogwood.	Eastern white pine, tall purple willow, northern white-cedar, Siberian crabapple.	---	Carolina poplar.
16B: Crosier	---	American cranberrybush, silky dogwood, arrowwood.	White spruce, eastern white pine, northern white-cedar, black spruce, Austrian pine.	Norway spruce	Carolina poplar.
17: Rensselaer	Gray dogwood, dwarf purple willow.	Redosier dogwood, Amur honeysuckle, silky dogwood.	Northern white-cedar, medium purple willow, tall purple willow.	---	Lombardy poplar.
19A: Brady	---	Silky dogwood, whitebelle honeysuckle, Tatarian honeysuckle.	White spruce, northern white-cedar, eastern white pine, blue spruce, European larch.	Norway spruce, red pine.	Carolina poplar, green ash.
20: Gilford	---	Austrian pine, white spruce, shadblow serviceberry, silky dogwood, hawthorn.	Eastern white pine, Norway spruce, green ash, northern white-cedar, black spruce.	---	Carolina poplar.
22A: Monitor	Cutleaf staghorn sumac.	Blackhaw, arrowwood, cornelian cherry dogwood, rose-of-sharon, Amur honeysuckle, American cranberrybush, autumn-olive.	---	American basswood, Norway spruce, white spruce.	Eastern white pine.
23: Sebewa	---	Silky dogwood, Amur privet.	White spruce, eastern white pine, northern white-cedar, Austrian pine, Norway spruce.	---	Carolina polar.
25: Lenawee	---	Silky dogwood, autumn-olive.	Eastern white pine, Norway spruce, tall purple willow.	Northern white-cedar.	Green ash.
26A: Pipestone	---	American cranberrybush, Tatarian honeysuckle.	White spruce, Austrian pine, European larch, northern white-cedar.	---	Green ash, Carolina poplar.

See footnote at end of table.

TABLE 10.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
27B, 27C---------- Tustin	Manyflower cotoneaster.	Lilac-------------	Norway spruce, Siberian peashrub.	Eastern white pine, red pine, jack pine.	---
28B--------------- Rimer	---	Medium purple willow, redosier dogwood, silky dogwood, gray dogwood, American cranberrybush.	Northern white-cedar, Norway spruce.	Eastern white pine, European alder, pin oak.	---
29---------------- Cohoctah	Gray dogwood------	Amur privet, silky dogwood, Austrian pine, Amur honeysuckle, redosier dogwood, silky dogwood.	Northern white-cedar, Siberian crabapple, white spruce.	---	Green ash, Carolina poplar.
30---------------- Belleville	---	Silky dogwood, Amur privet, Austrian pine.	Black spruce, nothern white-cedar, eastern white pine, Norway spruce.	---	Carolina poplar.
31A--------------- Kibbie	---	Silky dogwood, white spruce, blue spruce, American cranberrybush.	Northern white-cedar, eastern white pine, green ash.	Norway spruce, red pine.	Carolina poplar, white ash.
32---------------- Pella	Redosier dogwood, gray dogwood.	Amur maple, silky dogwood, oriental arborvitae.	Russian-olive, baldcypress.	Norway spruce, green ash.	Eastern cottonwood, pin oak, American sycamore.
33D, 33E---------- Morley	Gray dogwood, redosier dogwood, arrowwood.	Autumn-olive, silky dogwood.	Eastern redcedar, flowering dogwood, Amur maple.	Eastern white pine, Norway spruce, Douglas-fir.	Eastern cottonwood.
34B--------------- Blount	---	American cranberrybush, Amur privet, blue spruce, white spruce, late lilac.	Austrian pine, northern white-cedar.	Red pine, Norway spruce.	Green ash.
35*:					
Aquents.					
Histosols.					
36---------------- Pewamo	---	Silky dogwood, Amur privet, white spruce.	Black spruce, northern white-cedar, green ash, Siberian crabapple, eastern white pine.	Norway spruce-----	Carolina poplar, European alder.
37---------------- Granby	---	Silky dogwood, Amur privet, white spruce, Austrian pine.	Eastern white pine, northern white-cedar, Norway spruce, tamarack.	---	---

See footnote at end of table.

TABLE 10.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of-- <8	8-15	16-25	26-35	>35
38. Elvers					
42A Morocco	Manyflower cotoneaster.	Lilac, silky dogwood.	Norway spruce, Siberian peashrub, Austrian pine, black spruce.	Eastern white pine, red pine, jack pine.	Green ash, Carolina poplar.
44A Coupee	Mockorange	European burningbush, blackhaw, late lilac, Amur honeysuckle, shadblow, serviceberry, American cranberrybush, autumn-olive.	Eastern hemlock	Eastern white pine, Norway spruce.	Honeylocust.
51*: Houghton	Vanhoutte spirea	Silky dogwood, Amur privet, white spruce, redosier dogwood.	Eastern white pine, tamarack, Austrian pine.	Northern white-cedar, Norway spruce, Scotch pine.	Carolina poplar.
Kerston	---	Amur privet, silky dogwood, white spruce.	Austrian pine, eastern white pine, nannyberry viburnum.	Northern white-cedar.	Tamarack, Carolina poplar.
52B Abscota	Silky dogwood	---	Black spruce, northern white-cedar.	Eastern white pine	Carolina poplar.
55 Edwards	---	Amur privet, redosier dogwood, silky dogwood.	Austrian pine, nannyberry viburnum, eastern white pine.	Scotch pine, northern white-cedar, Norway spruce.	Carolina poplar, green ash.
56B, 56C Martinsville	Mockorange	European burningbush, blackhaw, late lilac, Amur honeysuckle, shadblow serviceberry, American cranberrybush, autumn-olive.	Easern hemlock	Norway spruce	Eastern white pine, honeylocust.
57A Thetford	---	Silky dogwood, Tatarian honeysuckle.	White spruce, eastern white pine, northern white-cedar, Austrian pine.	Norway spruce, red pine.	Carolina poplar.
60B Plainfield	Manyflower cotoneaster.	Siberian peashrub, lilac, eastern redcedar, Tatarian honeysuckle, silver buffaloberry, northern white-cedar.	Eastern white pine, red pine, jack pine, Norway spruce, common hackberry.	---	---

See footnote at end of table.

TABLE 10.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
61A: Whitaker	---	Autumn-olive, Amur honeysuckle, American cranberrybush, blackhaw, shadblow serviceberry, arrowwood, cornelian cherry dogwood, rose-of-sharon.	---	Norway spruce, white spruce, American basswood.	Eastern white pine.
62. Poy					
63B, 63C: Metea	Silky dogwood	Autumn-olive, Amur privet, Tatarian honeysuckle, late lilac.	Red pine, white spruce.	Eastern white pine, Norway spruce.	Carolina poplar, European alder.
64A: Selfridge	---	Silky dogwood	Eastern white pine, northern white-cedar, Austrian pine.	Norway spruce	Green ash.
65F*: Udorthents.					
Udipsamments.					
66A: Landes Variant	---	Autumn-olive, silky dogwood, Tatarian honeysuckle.	Eastern white pine, northern white-cedar, tall purple willow, green ash, white spruce.	---	---
67A: Shoals	Gray dogwood, dwarf purple willow.	Redosier dogwood, silky dogwood, Amur honeysuckle.	Northern white-cedar, medium purple willow, tall purple willow.	---	Lombardy poplar.
68A*: Granby	---	Silky dogwood, Amur privet, white spruce, Austrian pine.	Eastern white pine, northern white-cedar, Norway spruce, tamarack.	---	---
Morocco	Manyflower cotoneaster.	Lilac, silky dogwood.	Norway spruce, Siberian peashrub, Austrian pine, black spruce.	Eastern white pine, red pine, jack pine.	Green ash, Carolina poplar.
69B*: Plainfield	Manyflower cotoneaster.	Siberian peashrub, lilac, eastern redcedar, Tatarian honeysuckle, silver buffaloberry, northern white-cedar.	Eastern white pine, red pine, jack pine, Norway spruce, common hackberry.	---	---
Urban land.					

See footnote at end of table.

TABLE 10.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
70A*:					
Thetford	---	Silky dogwood, Tatarian honeysuckle.	White spruce, eastern white pine, northern white-cedar, Austrian pine.	Norway spruce, red pine.	Carolina poplar.
Urban land.					
71*. Pits					
72B*: Udipsamments.					
Udorthents.					
75B*:					
Rimer	---	Medium purple willow, redosier dogwood, silky dogwood, gray dogwood, American cranberrybush.	Northern white-cedar, Norway spruce.	Eastern white pine, European alder, pin oak.	---
Urban land.					
76*. Urban land					
77B*:					
Oshtemo	Vanhoutte spirea, silky dogwood.	Autumn-olive, Tatarian honeysuckle, white spruce.	---	Eastern white pine, red pine, jack pine, Scotch pine.	Carolina poplar.
Urban land.					
78B*, 78C*, 78D*:					
Riddles	---	Autumn-olive	Northern white-cedar, red pine, white spruce.	Norway spruce, Scotch pine.	---
Oshtemo	Vanhoutte spirea, silky dogwood.	Autumn-olive, Tatarian honeysuckle, white spruce.	---	Eastern white pine, red pine, jack pine, Scotch pine.	Carolina poplar.
80*:					
Cohoctah	Gray dogwood	Amur privet, silky dogwood, Austrian pine, Amur honeysuckle, redosier dogwood, silky dogwood.	Northern white-cedar, Siberian crabapple, white spruce.	---	Green ash, Carolina poplar.
Urban land.					
82B*:					
Oshtemo	Vanhoutte spirea, silky dogwood.	Autumn-olive, Tatarian honeysuckle, white spruce.	---	Eastern white pine, red pine, jack pine, Scotch pine.	Carolina poplar.
Ockley	---	Autumn-olive, American cranberrybush, late lilac, Tatarian honey-suckle.	White spruce	Eastern white pine, Norway spruce.	Carolina poplar.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--RECREATIONAL DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
2*:					
Cohoctah	Severe: floods, wetness.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.	Severe: floods, wetness.
Abscota	Severe: floods.	Moderate: floods.	Severe: floods.	Moderate: floods.	Severe: floods.
3*. Beaches					
4*. Dune land					
5 Houghton	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.
6 Adrian	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.
7 Palms	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
10B Oakville	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Moderate: droughty.
10D Oakville	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.	Moderate: slope, droughty.
10F Oakville	Severe: too sandy, slope.	Severe: too sandy, slope.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope.
11B Oshtemo	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Slight	Moderate: small stones.
11C Oshtemo	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, small stones.	Slight	Moderate: small stones, slope.
11D, 11E Oshtemo	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope.	Severe: slope.
12A Ockley	Slight	Slight	Slight	Severe: erodes easily.	Slight.
12B Ockley	Slight	Slight	Moderate: slope.	Severe: erodes easily.	Slight.
12C Ockley	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
12D Ockley	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
13B Spinks	Slight	Slight	Moderate: slope, small stones.	Slight	Moderate: droughty.

See footnote at end of table.

TABLE 11.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
13C: Spinks	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: droughty, slope.
13D: Spinks	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
14B: Riddles	Slight	Slight	Moderate: slope, small stones.	Slight	Slight.
14C: Riddles	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
14D: Riddles	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
14E: Riddles	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
15C: Glynwood	Moderate: slope, percs slowly, wetness.	Moderate: slope, wetness, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
16B: Crosier	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
17: Rensselaer	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
19A: Brady	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
20: Gilford	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
22A: Monitor	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
23: Sebewa	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
25: Lenawee	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
26A: Pipestone	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
27B: Tustin	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Slight	Slight.
27C: Tustin	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Slight	Moderate: slope.
28B: Rimer	Severe: wetness, percs slowly.	Severe: percs slowly.	Severe: wetness, percs slowly.	Moderate: wetness.	Moderate: wetness, droughty.
29: Cohoctah	Severe: floods, wetness.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.	Severe: floods, wetness.

See footnote at end of table.

TABLE 11.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
30: Belleville	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
31A: Kibbie	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
32: Pella	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
33D, 33E: Morley	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
34B: Blount	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Severe: erodes easily.	Moderate: wetness.
35*:					
Aquents.					
Histosols.					
36: Pewamo	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
37: Granby	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
38: Elvers	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
42A: Morocco	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, droughty.
44A: Coupee	Slight	Slight	Slight	Slight	Slight.
51*:					
Houghton	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.
Kerston	Severe: floods, ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding, floods.	Severe: ponding, excess humus.	Severe: ponding, floods, excess humus.
52B: Abscota	Severe: floods.	Slight	Moderate: floods.	Slight	Moderate: floods.
55: Edwards	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: excess humus, ponding.
56B: Martinsville	Slight	Slight	Moderate: slope.	Slight	Slight.
56C: Martinsville	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
57A: Thetford	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, droughty.
60B: Plainfield	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: droughty.

See footnote at end of table.

TABLE 11.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
61A: Whitaker	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Severe: erodes easily.	Moderate: wetness.
62: Poy	Severe: ponding, percs slowly.	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding.	Severe: ponding.
63B: Metea	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
63C: Metea	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: droughty, slope.
64A: Selfridge	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
65F*:					
Udorthents.					
Udipsamments.					
66A: Landes Variant	Severe: floods.	Slight	Moderate: slope.	Slight	Slight.
67A: Shoals	Severe: floods, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, floods.
68A*:					
Granby	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Morocco	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, droughty.
69B*:					
Plainfield	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: droughty.
Urban land.					
70A*:					
Thetford	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, droughty.
Urban land.					
71*. Pits					
72B*:					
Udipsamments.					
Udorthents.					
75B*:					
Rimer	Severe: wetness, percs slowly.	Severe: percs slowly.	Severe: wetness, percs slowly.	Moderate: wetness.	Moderate: wetness, droughty.
Urban land.					

See footnote at end of table.

TABLE 11.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
76*. Urban land					
77B*:					
Oshtemo	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Slight	Moderate: small stones.
Urban land.					
78B*:					
Riddles	Slight	Slight	Moderate: slope, small stones.	Slight	Slight.
Oshtemo	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Slight	Moderate: small stones.
78C*:					
Riddles	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
Oshtemo	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, small stones.	Slight	Moderate: small stones, slope.
78D*:					
Riddles	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Oshtemo	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope.	Severe: slope.
80*:					
Cohoctah	Severe: floods, wetness.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.	Severe: floods, wetness.
Urban land.					
82B*:					
Oshtemo	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Slight	Moderate: small stones.
Ockley	Slight	Slight	Moderate: slope.	Severe: erodes easily.	Slight.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--WILDLIFE HABITAT

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
2*:										
Cohoctah----------	Poor	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
Abscota-----------	Poor	Fair	Fair	Fair	Fair	Poor	Very poor.	Fair	Fair	Very poor.
3*. Beaches										
4*. Dune land										
5----------------- Houghton	Fair	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
6----------------- Adrian	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
7----------------- Palms	Good	Poor	Poor	Poor	Poor	Good	Good	Fair	Poor	Poor.
10B--------------- Oakville	Poor	Poor	Fair	Fair	Fair	Poor	Very poor.	Poor	Fair	Very poor.
10D, 10F---------- Oakville	Poor	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
11B--------------- Oshtemo	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
11C--------------- Oshtemo	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
11D, 11E---------- Oshtemo	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
12A, 12B---------- Ockley	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
12C--------------- Ockley	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
12D--------------- Ockley	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
13B--------------- Spinks	Poor	Fair	Good	Fair	Fair	Poor	Very poor.	Fair	Fair	Very poor.
13C, 13D---------- Spinks	Poor	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
14B--------------- Riddles	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
14C--------------- Riddles	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
14D, 14E---------- Riddles	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.

See footnote at end of table.

TABLE 12.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba- ceous plants	Hardwood trees	Conif- erous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
15C----------------- Glynwood	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
16B----------------- Crosier	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
17------------------ Rensselaer	Fair	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
19A----------------- Brady	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
20------------------ Gilford	Fair	Poor	Poor	Poor	Poor	Good	Good	Fair	Poor	Good.
22A----------------- Monitor	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
23------------------ Sebewa	Good	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
25------------------ Lenawee	Fair	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
26A----------------- Pipestone	Fair	Poor	Fair	Poor	Poor	Poor	Fair	Poor	Poor	Poor.
27B, 27C------------ Tustin	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
28B----------------- Rimer	Poor	Fair	Good	Good	Good	Fair	Fair	Fair	Good	Fair.
29------------------ Cohoctah	Poor	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
30------------------ Belleville	Poor	Fair	Fair	Fair	Fair	Fair	Good	Fair	Fair	Fair.
31A----------------- Kibbie	Good	Good	Good	Good	Fair	Fair	Fair	Good	Good	Fair.
32------------------ Pella	Good	Good	Good	Fair	Poor	Good	Good	Good	Fair	Fair.
33D, 33E------------ Morley	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
34B----------------- Blount	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
35*:										
Aquents.										
Histosols.										
36------------------ Pewamo	Good	Fair	Fair	Fair	Fair	---	Good	Fair	Fair	Good.
37------------------ Granby	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.

See footnote at end of table.

TABLE 12.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
38----------------- Elvers	Good	Good	Good	Good	Poor	Good	Good	Good	Good	Good.
42A---------------- Morocco	Poor	Fair	Good	Fair	Fair	Fair	Very poor.	Fair	Fair	Poor.
44A---------------- Coupee	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
51*:										
Houghton-----------	Fair	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Kerston------------	Fair	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
52B---------------- Abscota	Poor	Fair	Good	Fair	Fair	Poor	Very poor.	Fair	Fair	Very poor.
55----------------- Edwards	Fair	Fair	Poor	Poor	Poor	Good	Good	Fair	Poor	Good.
56B---------------- Martinsville	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
52C---------------- Martinsville	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
57A---------------- Thetford	Poor	Fair	Good	Good	Good	Fair	Fair	Fair	Good	Fair.
60B---------------- Plainfield	Poor	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
61A---------------- Whitaker	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
62----------------- Poy	Good	Good	Good	Good	Good	Good	Fair	Good	Good	Fair.
63B---------------- Metea	Poor	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
63C---------------- Metea	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
64A---------------- Selfridge	Poor	Fair	Good	Good	Good	Fair	Fair	Fair	Good	Fair.
65F*:										
Udorthents.										
Udipsamments.										
66A---------------- Landes Variant	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
67A---------------- Shoals	Poor	Fair	Fair	Good	Good	Fair	Fair	Fair	Good	Fair.
68A*:										
Granby-------------	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Morocco------------	Poor	Fair	Good	Fair	Fair	Fair	Very poor.	Fair	Fair	Poor.

See footnote at end of table.

TABLE 12.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba- ceous plants	Hardwood trees	Conif- erous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
69B*:										
Plainfield	Poor	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
Urban land.										
70A*:										
Thetford	Poor	Fair	Good	Good	Good	Fair	Fair	Fair	Good	Fair.
Urban land.										
71*. Pits										
72B*:										
Udipsamments.										
Udorthents.										
75B*:										
Rimer	Poor	Fair	Good	Good	Good	Fair	Poor	Fair	Good	Poor.
Urban land.										
76*. Urban land										
77B*:										
Oshtemo	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Urban land.										
78B*:										
Riddles	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Oshtemo	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
78C*:										
Riddles	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Oshtemo	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
78D*:										
Riddles	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Oshtemo	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
80*:										
Cohoctah	Poor	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
Urban land.										
82B*:										
Oshtemo	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Ockley	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
2*:						
Cohoctah	Severe: wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, frost action, wetness.	Severe: floods, wetness.
Abscota	Severe: cutbanks cave.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
3*. Beaches						
4*. Dune land						
5 Houghton	Severe: ponding, excess humus.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, low strength, frost action.	Severe: excess humus, ponding.
6 Adrian	Severe: ponding, cutbanks cave, excess humus.	Severe: ponding, low strength.	Severe: ponding.	Severe: ponding, low strength.	Severe: ponding, low strength, frost action.	Severe: excess humus, ponding.
7 Palms	Severe: excess humus, ponding.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, frost action.	Severe: ponding, excess humus.
10B Oakville	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
10D Oakville	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope, droughty.
10F Oakville	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
11B Oshtemo	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: small stones.
11C Oshtemo	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: small stones, slope.
11D, 11E Oshtemo	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
12A Ockley	Severe: cutbanks cave.	Moderate: shrink-swell.	Moderate: shrink-swell.	shrink-swell.	Severe: low strength.	Slight.
12B Ockley	Severe: cutbanks cave.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Slight.
12C Ockley	Severe: cutbanks cave.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
12D Ockley	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.

See footnote at end of table.

TABLE 13.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
13B----------------- Spinks	Severe: cutbanks cave.	Slight----------	Slight----------	Slight----------	Slight----------	Moderate: droughty.
13C----------------- Spinks	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
13D----------------- Spinks	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
14B----------------- Riddles	Slight----------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Moderate: low strength, frost action.	Slight.
14C----------------- Riddles	Moderate: slope.	Moderate: slope, shrink-swell.	Moderate: slope, shrink-swell.	Severe: slope.	Moderate: low strength, slope, frost action.	Moderate: slope.
14D, 14E----------- Riddles	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
15C----------------- Glynwood	Severe: wetness.	Moderate: slope, shrink-swell, wetness.	Severe: wetness.	Severe: slope.	Severe: frost action, low strength.	Moderate: slope.
16B----------------- Crosier	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action, low strength.	Moderate: wetness.
17------------------ Rensselaer	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: low strength, ponding, frost action.	Severe: ponding.
19A----------------- Brady	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
20------------------ Gilford	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.
22A----------------- Monitor	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
23------------------ Sebewa	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: frost action, ponding.	Severe: ponding.
25------------------ Lenawee	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: low strength, ponding, frost action.	Severe: ponding.
26A----------------- Pipestone	Severe: wetness, cutbanks cave.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
27B----------------- Tustin	Slight----------	Slight----------	Severe: shrink-swell.	Moderate: slope.	Moderate: frost action.	Slight.
27C----------------- Tustin	Moderate: slope.	Moderate: slope.	Severe: shrink-swell.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope.

See footnote at end of table.

TABLE 13.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
28B----- Rimer	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness.	Severe: frost action.	Moderate: wetness, droughty.
29----- Cohoctah	Severe: wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, frost action, wetness.	Severe: floods, wetness.
30----- Belleville	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.
31A----- Kibbie	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
32----- Pella	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: low strength, ponding.	Severe: ponding.
33D, 33E----- Morley	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
34B----- Blount	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
35*:						
Aquents.						
Histosols.						
36----- Pewamo	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: low strength, ponding, frost action.	Severe: ponding.
37----- Granby	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
38----- Elvers	Severe: excess humus, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.
42A----- Morocco	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness, frost action.	Moderate: wetness, droughty.
44A----- Coupee	Severe: cutbanks cave.	Slight-----	Slight-----	Slight-----	Moderate: low strength.	Slight.
51*:						
Houghton-----	Severe: ponding, excess humus.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, low strength, frost action.	Severe: excess humus, ponding.
Kerston-----	Severe: cutbanks cave, excess humus, ponding.	Severe: floods, ponding, low strength.	Severe: floods, ponding.	Severe: floods, ponding, low strength.	Severe: ponding, floods, frost action.	Severe: ponding, floods, excess humus.
52B----- Abscota	Severe: cutbanks cave.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: floods.

See footnote at end of table.

TABLE 13.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
55----------------- Edwards	Severe: ponding, excess humus.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, frost action, low strength.	Severe: excess humus, ponding.
56B---------------- Martinsville	Severe: cutbanks cave.	Moderate: shrink-swell.	Slight---------	Moderate: shrink-swell, slope.	Moderate: low strength, frost action.	Slight.
56C---------------- Martinsville	Severe: cutbanks cave.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Moderate: low strength, slope, frost action.	Moderate: slope.
57A---------------- Thetford	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness, frost action.	Moderate: wetness, droughty.
60B---------------- Plainfield	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Severe: droughty.
61A---------------- Whitaker	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
62----------------- Poy	Severe: cutbanks cave, ponding.	Severe: ponding. shrink-swell.	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: low strength, ponding.	Severe: ponding.
63B---------------- Metea	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: droughty.
63C---------------- Metea	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
64A---------------- Selfridge	Severe: wetness, cutbanks cave.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
65F*: Udorthents.						
Udipsamments.						
66A---------------- Landes Variant	Moderate: wetness.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: frost action.	Slight.
67A---------------- Shoals	Severe: cutbanks cave, wetness, floods.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, frost action.	Severe: floods.
68A*: Granby------------	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Morocco-----------	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness, frost action.	Moderate: wetness, droughty.
69B*: Plainfield--------	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: droughty.
Urban land.						

See footnote at end of table.

TABLE 13.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
70A*:						
Thetford----------	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness, frost action.	Moderate: wetness, droughty.
Urban land.						
71*. Pits						
72B*: Udipsamments.						
Udorthents.						
75B*:						
Rimer-------------	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness.	Severe: frost action.	Moderate: wetness, droughty.
Urban land.						
76*. Urban land						
77B*:						
Oshtemo-----------	Severe: cutbanks cave.	Slight----------	Slight----------	Slight----------	Slight----------	Moderate: small stones.
Urban land.						
78B*:						
Riddles-----------	Slight----------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: low strength, frost action.	Slight.
Oshtemo-----------	Severe: cutbanks cave.	Slight----------	Slight----------	Slight----------	Slight----------	Moderate: small stones.
78C*:						
Riddles-----------	Moderate: slope.	Moderate: slope, shrink-swell.	Moderate: slope, shrink-swell.	Severe: slope.	Moderate: low strength, slope, frost action.	Moderate: slope.
Oshtemo-----------	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: small stones, slope.
78D*:						
Riddles-----------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Oshtemo-----------	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
80*:						
Cohoctah----------	Severe: wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, frost action, wetness.	Severe: floods, wetness.
Urban land.						
82B*:						
Oshtemo-----------	Severe: cutbanks cave.	Slight----------	Slight----------	Slight----------	Slight----------	Moderate: small stones.

See footnote at end of table.

TABLE 13.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
82B*:						
Ockley-----------	Severe: cutbanks cave.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," and "fair." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
2*:					
Cohoctah	Severe: wetness, floods.	Severe: floods, seepage, wetness.	Severe: seepage, floods, wetness.	Severe: seepage, floods, wetness.	Poor: wetness.
Abscota	Severe: floods, wetness, poor filter.	Severe: floods, seepage, wetness.	Severe: floods, seepage, wetness.	Severe: floods, seepage, wetness.	Poor: too sandy, seepage.
3*. Beaches					
4*. Dune land					
5 Houghton	Severe: ponding, percs slowly.	Severe: seepage, ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, seepage.	Poor: ponding, excess humus.
6 Adrian	Severe: ponding.	Severe: seepage, ponding, excess humus.	Severe: ponding, seepage.	Severe: ponding, seepage.	Poor: ponding, excess humus.
7 Palms	Severe: subsides, ponding.	Severe: seepage, excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, seepage.	Poor: ponding, excess humus.
10B Oakville	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
10D Oakville	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
10F Oakville	Severe: slope, poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy, slope.	Severe: seepage, slope.	Poor: too sandy, slope, seepage.
11B Oshtemo	Severe: poor filter.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: seepage.
11C Oshtemo	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Poor: seepage.
11D, 11E Oshtemo	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Poor: seepage, slope.
12A, 12B Ockley	Slight	Severe: seepage.	Severe: seepage.	Slight	Poor: small stones.
12C Ockley	Moderate: slope.	Severe: seepage, slope.	Severe: seepage.	Moderate: slope.	Poor: small stones.

See footnote at end of table.

TABLE 14.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
12D: Ockley	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: slope.	Poor: small stones, slope.
13B: Spinks	Severe: poor filter.	Severe: seepage.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.
13C: Spinks	Severe: poor filter.	Severe: seepage, slope.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.
13D: Spinks	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
14B: Riddles	Slight	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
14C: Riddles	Moderate: slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: slope, too clayey.
14D, 14E: Riddles	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
15C: Glynwood	Severe: percs slowly, wetness.	Severe: slope.	Moderate: wetness, too clayey, slope.	Moderate: slope, wetness.	Fair: slope, too clayey, wetness.
16B: Crosier	Severe: percs slowly, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
17: Rensselaer	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding, too sandy.	Severe: ponding.	Poor: too sandy, ponding.
19A: Brady	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Poor: wetness.
20: Gilford	Severe: ponding, poor filter.	Severe: seepage, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
22A: Monitor	Severe: wetness, percs slowly.	Severe: wetness.	Severe: seepage, wetness.	Severe: wetness.	Poor: wetness.
23: Sebewa	Severe: poor filter, ponding.	Severe: seepage, ponding.	Severe: seepage, ponding.	Severe: seepage, ponding.	Poor: small stones, seepage, too sandy.
25: Lenawee	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Poor: ponding.
26A: Pipestone	Severe: wetness, poor filter.	Severe: wetness, seepage.	Severe: wetness, seepage, too sandy.	Severe: wetness, seepage.	Poor: too sandy, seepage, wetness.

See footnote at end of table.

TABLE 14.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
27B----------------- Tustin	Severe: percs slowly, poor filter.	Severe: seepage.	Severe: too clayey.	Severe: seepage.	Poor: too clayey, hard to pack.
27C----------------- Tustin	Severe: percs slowly, poor filter.	Severe: seepage, slope.	Severe: too clayey.	Severe: seepage.	Poor: too clayey, hard to pack.
28B----------------- Rimer	Severe: wetness, percs slowly.	Severe: seepage.	Severe: wetness, too clayey.	Severe: seepage, wetness.	Poor: too clayey, hard to pack, wetness.
29------------------ Cohoctah	Severe: wetness, floods.	Severe: floods, seepage, wetness.	Severe: seepage, floods, wetness.	Severe: seepage, floods, wetness.	Poor: wetness.
30------------------ Belleville	Severe: ponding, percs slowly.	Severe: seepage, ponding.	Severe: ponding.	Severe: seepage, ponding.	Poor: ponding.
31A----------------- Kibbie	Severe: wetness.	Severe: wetness.	Severe: wetness, too sandy.	Severe: wetness.	Poor: too sandy, wetness.
32------------------ Pella	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Poor: ponding.
33D, 33E------------ Morley	Severe: wetness, percs slowly, slope.	Severe: slope, wetness.	Severe: slope.	Severe: slope.	Poor: slope.
34B----------------- Blount	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
35*: Aquents.					
Histosols.					
36------------------ Pewamo	Severe: percs slowly, ponding.	Severe: ponding.	Severe: ponding, too clayey.	Severe: ponding.	Poor: too clayey, ponding, hard to pack.
37------------------ Granby	Severe: ponding, poor filter.	Severe: seepage, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
38------------------ Elvers	Severe: ponding, percs slowly.	Severe: seepage, ponding, excess humus.	Severe: ponding.	Severe: ponding, seepage.	Poor: ponding, thin layer.
42A----------------- Morocco	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, too sandy, wetness.	Severe: seepage, wetness.	Poor: too sandy, wetness, seepage.
44A----------------- Coupee	Severe: poor filter.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: thin layer.

See footnote at end of table.

TABLE 14.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
51*:					
Houghton	Severe: ponding, percs slowly.	Severe: seepage, ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, seepage.	Poor: ponding, excess humus.
Kerston	Severe: floods, ponding, percs slowly.	Severe: seepage, floods, excess humus.	Severe: floods, seepage, ponding.	Severe: floods, seepage, ponding.	Poor: seepage, too sandy, ponding.
52B Abscota	Severe: floods, wetness, poor filter.	Severe: floods, seepage, wetness.	Severe: floods, seepage, wetness.	Severe: floods, seepage, wetness.	Poor: too sandy, seepage.
55 Edwards	Severe: ponding, percs slowly.	Severe: ponding, seepage, excess humus.	Severe: ponding.	Severe: ponding, seepage.	Poor: ponding, excess humus.
56B Martinsville	Slight	Moderate: seepage, slope.	Slight	Slight	Fair: thin layer.
56C Martinsville	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope, thin layer.
57A Thetford	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Poor: wetness, thin layer.
60B Plainfield	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
61A Whitaker	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: wetness.	Poor: wetness.
62 Poy	Severe: ponding, percs slowly.	Severe: seepage, ponding.	Severe: seepage, ponding.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
63B Metea	Severe: percs slowly.	Severe: seepage.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.
63C Metea	Severe: percs slowly.	Severe: seepage, slope.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.
64A Selfridge	Severe: percs slowly, wetness, poor filter.	Severe: wetness, seepage.	Severe: wetness.	Severe: wetness, seepage.	Poor: wetness.
65F*:					
Udorthents.					
Udipsamments.					
66A Landes Variant	Severe: wetness, poor filter.	Severe: seepage.	Severe: seepage, wetness.	Severe: seepage.	Good.

See footnote at end of table.

TABLE 14.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
67A------------------ Shoals	Severe: floods, wetness.	Severe: seepage, floods, wetness.	Severe: floods, seepage, wetness.	Severe: floods, seepage, wetness.	Poor: wetness.
68A*:					
Granby--------------	Severe: ponding, poor filter.	Severe: seepage, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
Morocco-------------	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, too sandy, wetness.	Severe: seepage, wetness.	Poor. too sandy, wetness, seepage.
69B*:					
Plainfield----------	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
Urban land.					
70A*:					
Thetford------------	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Poor: wetness, thin layer.
Urban land.					
71*. Pits					
72B*:					
Udipsamments.					
Udorthents.					
75B*:					
Rimer---------------	Severe: wetness, percs slowly.	Severe: seepage.	Severe: wetness, too clayey.	Severe: seepage, wetness.	Poor: too clayey, hard to pack, wetness.
Urban land.					
76*. Urban land					
77B*:					
Oshtemo-------------	Severe: poor filter.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: seepage.
Urban land.					
78B*:					
Riddles-------------	Slight--------------	Moderate: seepage, slope.	Moderate: too clayey.	Slight--------------	Fair: too clayey.
Oshtemo-------------	Severe: poor filter.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: seepage.
78C*:					
Riddles-------------	Moderate: slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: slope, too clayey.

See footnote at end of table.

TABLE 14.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
78C*:					
Oshtemo------------	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Poor: seepage.
78D*:					
Riddles------------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Oshtemo------------	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Poor: seepage, slope.
80*:					
Cohoctah-----------	Severe: wetness, floods.	Severe: floods, seepage, wetness.	Severe: seepage, floods, wetness.	Severe: seepage, floods, wetness.	Poor: wetness.
Urban land.					
82B*:					
Oshtemo------------	Severe: poor filter.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: seepage.
Ockley-------------	Slight-----------	Severe: seepage.	Severe: seepage.	Slight-----------	Poor: small stones.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," "poor," "probable," and "improbable." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
2*:				
Cohoctah	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Abscota	Fair: wetness.	Probable	Improbable: too sandy.	Poor: too sandy.
3*. Beaches				
4*. Dune land				
5 Houghton	Poor: wetness, low strength.	Improbable: excess humus.	Improbable: excess humus.	Poor: wetness, excess humus.
6 Adrian	Poor: wetness, low strength.	Probable	Improbable: too sandy.	Poor: wetness, excess humus.
7 Palms	Poor: wetness.	Improbable: excess humus, excess fines.	Improbable: excess humus, excess fines.	Poor: wetness, excess humus.
10B, 10D Oakville	Good	Probable	Improbable: too sandy.	Poor: too sandy.
10F Oakville	Poor: slope.	Probable	Improbable: too sandy.	Poor: too sandy, slope.
11B, 11C Oshtemo	Good	Probable	Probable	Poor: small stones.
11D, 11E Oshtemo	Fair: slope.	Probable	Probable	Poor: small stones, slope.
12A, 12B, 12C Ockley	Good	Probable	Probable	Poor: small stones.
12D Ockley	Fair: slope.	Probable	Probable	Poor: small stones, slope.
13B Spinks	Good	Probable	Improbable: too sandy.	Fair: too sandy.
13C Spinks	Good	Probable	Improbable: too sandy.	Fair: slope, too sandy.
13D Spinks	Fair: slope.	Probable	Improbable: too sandy.	Poor: slope.
14B Riddles	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.

See footnote at end of table.

TABLE 15.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
14C------------------- Riddles	Good-----------------	Improbable: excess fines.	Improbable: excess fines.	Fair: slope, small stones.
14D------------------- Riddles	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
14E------------------- Riddles	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
15C------------------- Glynwood	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
16B------------------- Crosier	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
17-------------------- Rensselaer	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
19A------------------- Brady	Fair: wetness.	Probable-------------	Probable-------------	Poor: small stones.
20-------------------- Gilford	Poor: wetness.	Probable-------------	Improbable: too sandy.	Poor: wetness.
22A------------------- Monitor	Fair: wetness.	Probable-------------	Probable-------------	Fair: small stones.
23-------------------- Sebewa	Poor: wetness.	Probable-------------	Probable-------------	Poor: wetness, small stones, area reclaim.
25-------------------- Lenawee	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, wetness.
26A------------------- Pipestone	Poor: wetness.	Probable-------------	Improbable: too sandy.	Poor: wetness.
27B------------------- Tustin	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy.
27C------------------- Tustin	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope, too sandy.
28B------------------- Rimer	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, too sandy.
29-------------------- Cohoctah	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
30-------------------- Belleville	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
31A------------------- Kibbie	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim.
32-------------------- Pella	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
33D, 33E-------------- Morley	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, slope.

See footnote at end of table.

TABLE 15.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
34B Blount	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
35*: Aquents.				
Histosols.				
36 Pewamo	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
37 Granby	Poor: wetness.	Probable	Improbable: too sandy.	Poor: wetness.
38 Elvers	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
42A Morocco	Fair: wetness.	Probable	Improbable: too sandy.	Fair: too sandy.
44A Coupee	Good	Probable	Probable	Fair: thin layer, small stones, area reclaim.
51*: Houghton	Poor: wetness, low strength.	Improbable: excess humus.	Improbable: excess humus.	Poor: wetness, excess humus.
Kerston	Poor: wetness.	Probable	Improbable: too sandy.	Poor: excess humus, wetness.
52B Abscota	Fair: wetness.	Probable	Improbable: too sandy.	Poor: too sandy.
55 Edwards	Poor: wetness, low strength.	Improbable: excess humus.	Improbable: excess humus.	Poor: wetness, excess humus.
56B Martinsville	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
56C Martinsville	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, slope.
57A Thetford	Fair: wetness.	Probable	Improbable: too sandy.	Fair: too sandy, small stones.
60B Plainfield	Good	Probable	Improbable: too sandy.	Poor: too sandy.
61A Whitaker	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
62 Poy	Poor: wetness.	Probable	Improbable: too sandy.	Poor: wetness.
63B Metea	Poor: thin layer.	Improbable: thin layer.	Improbable: too sandy.	Fair: too sandy.
63C Metea	Poor: thin layer.	Improbable: thin layer.	Improbable: too sandy.	Fair: too sandy, slope.

See footnote at end of table.

TABLE 15.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
64A: Selfridge	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy, small stones.
65F*:				
Udorthents.				
Udipsamments.				
66A: Landes Variant	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
67A: Shoals	Poor: wetness.	Probable	Improbable: too sandy.	Good.
68A*:				
Granby	Poor: wetness.	Probable	Improbable: too sandy.	Poor: wetness.
Morocco	Fair: wetness.	Probable	Improbable: too sandy.	Fair: too sandy.
69B*:				
Plainfield	Good	Probable	Improbable: too sandy.	Poor: thin layer.
Urban land.				
70A*:				
Thetford	Fair: wetness.	Probable	Improbable: too sandy.	Fair: too sandy, small stones.
Urban land.				
71*. Pits				
72B*:				
Udipsamments.				
Udorthents.				
75B*:				
Rimer	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, too sandy.
Urban land.				
76*. Urban land				
77B*:				
Oshtemo	Good	Probable	Probable	Poor: small stones.
Urban land.				
78B*:				
Riddles	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Oshtemo	Good	Probable	Probable	Poor: small stones.

See footnote at end of table.

TABLE 15.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
78C*:				
Riddles	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: slope, small stones.
Oshtemo	Good	Probable	Probable	Poor: small stones.
78D*:				
Riddles	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Oshtemo	Fair: slope.	Probable	Probable	Poor: small stones, slope.
80*:				
Cohoctah	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Urban land.				
82B*:				
Oshtemo	Good	Probable	Probable	Poor: small stones.
Ockley	Good	Probable	Probable	Poor: small stones.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated]

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Grassed waterways
2*:						
Cohoctah	Severe: seepage.	Severe: piping, wetness.	Slight	Floods, frost action.	Wetness, soil blowing.	Wetness.
Abscota	Severe: seepage.	Severe: seepage, piping.	Severe: cutbanks cave.	Floods, slope, cutbanks cave.	Droughty, wetness.	Droughty.
3*. Beaches						
4*. Dune land						
5 Houghton	Severe: seepage.	Severe: excess humus, ponding.	Severe: slow refill.	Frost action, subsides, ponding.	Soil blowing, ponding.	Wetness.
6 Adrian	Severe: seepage.	Severe: seepage, ponding, excess humus.	Severe: slow refill, cutbanks cave.	Ponding, frost action, subsides.	Ponding, soil blowing.	Wetness.
7 Palms	Severe: seepage.	Severe: excess humus, ponding.	Severe: slow refill.	Floods, ponding, subsides.	Ponding, soil blowing.	Wetness.
10B Oakville	Severe: seepage.	Severe: piping, seepage.	Severe: no water.	Deep to water	Fast intake, droughty, soil blowing.	Droughty.
10D, 10F Oakville	Severe: seepage, slope.	Severe: piping, seepage.	Severe: no water.	Deep to water	Fast intake, droughty, soil blowing.	Slope, droughty.
11B Oshtemo	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Soil blowing, slope.	Favorable.
11C, 11D, 11E Oshtemo	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Soil blowing, slope.	Slope.
12A Ockley	Moderate: seepage.	Moderate: thin layer.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
12B Ockley	Moderate: seepage, slope.	Moderate: thin layer.	Severe: no water.	Deep to water	Slope, erodes easily.	Erodes easily.
12C, 12D Ockley	Severe: slope.	Moderate: thin layer.	Severe: no water.	Deep to water	Slope, erodes easily.	Slope, erodes easily.
13B Spinks	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Droughty, fast intake, soil blowing.	Droughty.
13C, 13D Spinks	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Droughty, fast intake, soil blowing.	Slope, droughty.
14B Riddles	Moderate: seepage, slope.	Slight	Severe: no water.	Deep to water	Slope	Favorable.

See footnote at end of table.

TABLE 16.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Grassed waterways
14C, 14D, 14E----- Riddles	Severe: slope.	Slight---------	Severe: no water.	Deep to water	Slope----------	Slope.
15C--------------- Glynwood	Severe: slope.	Moderate: wetness, piping.	Severe: no water.	Slope, percs slowly, frost action.	Percs slowly, wetness.	Slope, erodes easily.
16B--------------- Crosier	Slight---------	Severe: piping, wetness.	Severe: slow refill.	Frost action---	Wetness--------	Wetness.
17---------------- Rensselaer	Moderate: seepage.	Severe: piping, ponding.	Severe: slow refill.	Ponding, percs slowly, frost action.	Ponding, percs slowly.	Wetness, percs slowly.
19A--------------- Brady	Severe: seepage.	Severe: piping, wetness.	Severe: cutbanks cave.	Frost action---	Wetness, soil blowing.	Wetness.
20---------------- Gilford	Severe: seepage.	Severe: seepage, piping, ponding.	Severe: cutbanks cave.	Ponding, frost action, cutbanks cave.	Ponding, soil blowing.	Wetness.
22A--------------- Monitor	Slight---------	Severe: wetness.	Severe: slow refill, cutbanks cave.	Frost action---	Wetness--------	Wetness.
23---------------- Sebewa	Severe: seepage.	Severe: seepage, ponding.	Moderate: slow refill, cutbanks cave.	Frost action, cutbanks cave, ponding.	Ponding--------	Wetness.
25---------------- Lenawee	Moderate: seepage.	Severe: piping, ponding.	Severe: slow refill.	Ponding, frost action.	Ponding--------	Wetness.
26A--------------- Pipestone	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Cutbanks cave	Fast intake, wetness, droughty.	Droughty, wetness.
27B--------------- Tustin	Severe: seepage.	Severe: hard to pack.	Severe: no water.	Deep to water	Fast intake, soil blowing.	Erodes easily.
27C--------------- Tustin	Severe: seepage, slope.	Severe: hard to pack.	Severe: no water.	Deep to water	Fast intake, soil blowing.	Slope, erodes easily.
28B--------------- Rimer	Severe: seepage.	Severe: wetness.	Severe: no water.	Percs slowly, frost action.	Wetness, droughty, fast intake.	Wetness, droughty, rooting depth.
29---------------- Cohoctah	Severe: seepage.	Severe: piping, wetness.	Slight---------	Floods, frost action.	Wetness, soil blowing.	Wetness.
30---------------- Belleville	Severe: seepage.	Severe: ponding.	Severe: slow refill, cutbanks cave.	Ponding, frost action.	Ponding, droughty, fast intake.	Wetness, droughty.
31A--------------- Kibbie	Moderate: seepage.	Severe: piping, wetness.	Severe: cutbanks cave.	Frost action, cutbanks cave.	Wetness--------	Wetness, erodes easily.
32---------------- Pella	Moderate: seepage.	Severe: wetness.	Moderate: slow refill.	Frost action---	Ponding--------	Wetness.
33D, 33E---------- Morley	Severe: slope.	Moderate: piping.	Severe: no water.	Deep to water	Percs slowly, slope.	Slope, erodes easily.

See footnote at end of table.

TABLE 16.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Grassed waterways
34B---------------- Blount	Slight---------	Moderate: piping, wetness.	Severe: no water.	Percs slowly, frost action.	Wetness, percs slowly.	Wetness, erodes easily.
35*: Aquents.						
Histosols.						
36---------------- Pewamo	Slight---------	Severe: ponding.	Severe: slow refill.	Ponding, frost action.	Ponding---------	Wetness.
37---------------- Granby	Severe: seepage.	Severe: seepage, piping, ponding.	Severe: cutbanks cave.	Ponding, cutbanks cave.	Ponding, droughty, fast intake.	Wetness, droughty.
38---------------- Elvers	Severe: seepage.	Severe: piping, wetness.	Severe: slow refill, cutbanks cave.	Frost action---	Ponding---------	Wetness.
42A--------------- Morocco	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Cutbanks cave	Droughty, fast intake, wetness.	Wetness, droughty.
44A--------------- Coupee	Severe: seepage.	Severe: thin layer.	Severe: no water.	Deep to water	Favorable-------	Favorable.
51*: Houghton----------	Severe: seepage.	Severe: excess humus, ponding.	Severe: slow refill.	Frost action, subsides, ponding.	Soil blowing, ponding.	Wetness.
Kerston----------	Severe: seepage.	Severe: seepage, piping, ponding.	Severe: slow refill, cutbanks cave.	Ponding, floods, subsides.	Ponding, soil blowing, floods.	Wetness.
52B--------------- Abscota	Severe: seepage.	Severe: seepage, piping.	Severe: cutbanks cave.	Floods, slope, cutbanks cave.	Droughty, wetness.	Droughty.
55---------------- Edwards	Severe: seepage.	Severe: ponding.	Severe: slow refill.	Frost action, ponding, subsides.	Ponding, soil blowing.	Wetness.
56B--------------- Martinsville	Moderate: seepage, slope.	Severe: thin layer.	Severe: no water.	Deep to water	Soil blowing, slope.	Erodes easily.
56C--------------- Martinsville	Severe: slope.	Severe: thin layer.	Severe: no water.	Deep to water	Soil blowing, slope.	Slope, erodes easily.
57A--------------- Thetford	Severe: seepage.	Severe: piping, wetness.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty, fast intake.	Wetness, droughty.
60B--------------- Plainfield	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Droughty, fast intake, soil blowing.	Droughty.
61A--------------- Whitaker	Moderate: seepage.	Severe: wetness.	Moderate: slow refill, cutbanks cave.	Frost action---	Wetness---------	Wetness, erodes easily.
62---------------- Poy	Severe: seepage.	Severe: seepage, piping, ponding.	Severe: no water.	Percs slowly, frost action.	Ponding, percs slowly.	Wetness.

See footnote at end of table.

TABLE 16.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Limitations for-- Embankments, dikes, and levees	Limitations for-- Aquifer-fed excavated ponds	Features affecting-- Drainage	Features affecting-- Irrigation	Features affecting-- Grassed waterways
63B---------------- Metea	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Droughty, fast intake, soil blowing.	Droughty.
63C---------------- Metea	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Droughty, fast intake, soil blowing.	Slope, droughty.
64A---------------- Selfridge	Severe: seepage.	Severe: wetness.	Severe: slow refill, cutbanks cave.	Frost action---	Wetness, fast intake, soil blowing.	Wetness, erodes easily.
65F*: Udorthents.						
Udipsamments.						
66A---------------- Landes Variant	Severe: seepage.	Severe: piping.	Moderate: deep to water.	Deep to water	Favorable-------	Favorable.
67A---------------- Shoals	Severe: seepage.	Severe: piping, wetness.	Severe: cutbanks cave.	Floods, frost action.	Wetness, floods, erodes easily.	Erodes easily, wetness.
68A*: Granby------------	Severe: seepage.	Severe: seepage, piping, ponding.	Severe: cutbanks cave.	Ponding, cutbanks cave.	Ponding, droughty, fast intake.	Wetness, droughty.
Morocco-----------	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Cutbanks cave	Droughty, fast intake, wetness.	Wetness, droughty.
69B*: Plainfield--------	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Droughty, fast intake, soil blowing.	Droughty.
Urban land.						
70A*: Thetford----------	Severe: seepage.	Severe: piping, wetness.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty, fast intake.	Wetness, droughty.
Urban land.						
71*. Pits						
72B*: Udipsamments.						
Udorthents.						
75B*: Rimer-------------	Severe: seepage.	Severe: wetness.	Severe: no water.	Percs slowly, frost action.	Wetness, droughty, fast intake.	Wetness, droughty, rooting depth.
Urban land.						
76*. Urban land						

See footnote at end of table.

TABLE 16.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Grassed waterways
77B*:						
Oshtemo	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Soil blowing, slope.	Favorable.
Urban land.						
78B*:						
Riddles	Moderate: seepage, slope.	Slight	Severe: no water.	Deep to water	Slope	Favorable.
Oshtemo	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Soil blowing, slope.	Favorable.
78C*, 78D*:						
Riddles	Severe: slope.	Slight	Severe: no water.	Deep to water	Slope	Slope.
Oshtemo	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Soil blowing, slope.	Slope.
80*:						
Cohoctah	Severe: seepage.	Severe: piping, wetness.	Slight	Floods, frost action.	Wetness, soil blowing.	Wetness.
Urban land.						
82B*:						
Oshtemo	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Soil blowing	Favorable.
Ockley	Moderate: seepage.	Moderate: thin layer.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--ENGINEERING INDEX PROPERTIES

[The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
2*: Cohoctah	0-15	Sandy loam	ML, SM	A-4, A-2	0	100	100	65-95	30-75	<30	NP-6
	15-42	Loamy sand, fine sandy loam, silt loam.	ML, SM, SC, CL	A-4, A-2	0	95-100	80-100	70-90	30-70	<30	NP-10
	42-60	Loam, fine sand, loamy sand.	ML, SM, SC, CL	A-4, A-2	0	95-100	80-100	65-90	20-70	<30	NP-10
Abscota	0-10	Sandy loam	SM, SM-SC, SC	A-2-4, A-4	0	95-100	95-100	60-70	30-40	<25	NP-10
	10-39	Sand	SP, SM, SP-SM	A-2-4, A-1, A-3	0	95-100	95-100	45-65	0-15	---	NP
	39-60	Sand, coarse sand	SP-SM, SP	A-1, A-3, A-2-4	0	95-100	95-100	45-60	0-10	---	NP
3*. Beaches											
4*. Dune land											
5 Houghton	0-60	Sapric material	Pt	A-8	0	---	---	---	---	---	---
6 Adrian	0-26	Sapric material	Pt	A-8	---	---	---	---	---	---	---
	26-60	Sand, loamy fine sand, fine sand.	SP, SM	A-2, A-3, A-1	0	80-100	60-100	35-75	0-30	---	NP
7 Palms	0-40	Sapric material	PT	---	---	---	---	---	---	---	---
	40-60	Clay loam, silty clay loam, fine sandy loam.	CL-ML, CL	A-4, A-6	0	85-100	80-100	70-95	50-90	25-40	5-20
10B, 10D, 10F Oakville	0-10	Fine sand	SM, SP, SP-SM	A-2, A-3	0	100	100	50-85	0-35	---	NP
	10-60	Fine sand	SM, SP, SP-SM	A-2, A-3	0	100	95-100	65-95	0-25	---	NP
11B, 11C, 11D, 11E Oshtemo	0-10	Sandy loam	SM, SM-SC	A-2, A-4	0	95-100	60-95	60-70	25-40	15-25	2-7
	10-33	Sandy loam, sandy clay loam.	SM, SC, SM-SC	A-2, A-4, A-6	0	95-100	60-95	60-85	25-45	12-30	2-16
	33-41	Loamy sand	SM, SP-SM	A-2	0	85-95	60-95	55-70	10-15	---	NP
	41-60	Stratified sand to gravel.	SP-SM, GP, SP, GP-GM	A-1, A-2, A-3	0-5	40-90	35-85	20-60	0-10	---	NP
12A, 12B, 12C, 12D Ockley	0-9	Loam	CL, ML, CL-ML	A-4, A-6	0	100	95-100	80-100	60-90	22-33	3-12
	9-45	Gravelly clay loam, gravelly sandy clay loam, sandy loam.	CL, SC, GC	A-6, A-7	0-2	70-85	45-75	40-70	35-55	30-50	15-30
	45-60	Stratified loamy sand to gravelly sand.	SP, SP-SM, GP, GP-GM	A-1	1-5	30-70	20-55	5-20	2-10	---	NP
13B, 13C, 13D Spinks	0-10	Loamy fine sand	SM	A-2-4	0	100	80-100	50-90	15-30	---	NP
	10-60	Stratified sand to loamy fine sand.	SM, SP-SM	A-2-4	0	100	80-100	60-90	10-30	---	NP
14B, 14C, 14D, 14E Riddles	0-7	Loam	CL	A-4, A-6	0	95-100	85-95	80-90	60-75	20-35	8-15
	7-55	Sandy clay loam, clay loam, loam.	CL, SC	A-6	0	90-100	80-95	75-90	35-75	25-40	10-20
	55-63	Clay loam, sandy loam, loam.	CL, SM, SC, ML	A-4, A-6, A-2	0-3	85-95	80-90	50-90	30-70	15-30	2-15

See footnote at end of table.

TABLE 17.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag-ments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas-ticity index
	In				Pct					Pct	
15C---------------Glynwood	0-7	Loam-------------	CL-ML, CL	A-4, A-6	0	95-100	90-100	80-100	55-90	23-40	4-15
	7-26	Clay, clay loam, silty clay loam.	CL, CH	A-7, A-6	0-5	95-100	85-100	75-100	65-95	35-55	15-30
	26-60	Clay loam, silty clay loam.	CL	A-6, A-4	0-5	95-100	80-100	75-95	65-90	25-40	7-18
16B---------------Crosier	0-9	Silt loam--------	CL	A-4, A-6	0	100	95-100	85-95	60-80	22-33	8-15
	9-46	Silty clay loam, silt loam, sandy clay loam.	CL	A-6, A-7	0	90-95	85-95	75-90	60-70	33-47	15-26
	46-60	Silt loam--------	CL, ML	A-4, A-6	0-3	85-90	80-88	70-85	50-60	25-35	2-12
17----------------Rensselaer	0-10	Silt loam--------	CL, ML	A-4, A-6	0	100	100	90-100	70-90	27-36	4-12
	10-35	Clay loam, silt loam, loam.	CL	A-6, A-7	0	95-100	90-100	80-100	60-80	33-47	15-26
	35-47	Sandy clay loam, loam.	CL, SC	A-6	0	95-100	90-100	75-95	35-55	25-35	11-16
	47-60	Stratified fine sand to clay loam.	CL, SC, CL-ML, SM-SC	A-4, A-2	0	95-100	90-100	60-95	20-70	<30	4-9
19A---------------Brady	0-11	Sandy loam-------	SM, SM-SC	A-2, A-4	0-5	95-100	75-100	60-70	25-40	<25	NP-7
	11-35	Sandy loam, sandy clay loam.	SM, SC, SM-SC	A-2, A-4, A-6	0-5	95-100	75-95	60-80	25-45	15-35	NP-16
	35-48	Loamy sand, loam.	SM	A-2	0-5	95-100	75-95	55-70	15-35	---	NP
	48-60	Stratified sand to gravel.	SP, SP-SM, GP, GP-GM	A-1, A-3, A-2-4	0-5	40-75	35-70	20-55	0-10	---	NP
20----------------Gilford	0-11	Sandy loam-------	SC, SM-SC	A-4, A-2-4	0	95-100	90-100	60-70	30-40	20-30	4-10
	11-33	Sandy loam, fine sandy loam.	SM, SC, SM-SC	A-2-4	0	90-100	90-100	55-70	20-35	15-30	NP-8
	33-60	Loamy sand, sand	SM, SP, SP-SM	A-3, A-1-b, A-2-4	0	90-100	85-100	18-60	3-20	---	NP
22A---------------Monitor	0-16	Loam, silt loam	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-90	25-35	5-15
	16-28	Sandy clay loam	SC, CL	A-6	0	95-100	90-95	80-90	35-55	25-35	10-15
	28-55	Clay loam, gravelly clay loam, sandy loam.	CL	A-6	0-3	85-95	75-95	70-95	55-75	30-40	15-25
	55-60	Stratified sand to gravelly loamy sand.	SP, SP-SM, GP, GP-GM	A-1-b, A-1-a	1-5	30-70	20-55	5-20	0-10	---	NP
23----------------Sebewa	0-13	Loam-------------	CL, CL-ML	A-4, A-6	0	95-100	80-100	75-95	50-90	22-35	6-12
	13-29	Sandy clay loam, loam, gravelly clay loam, clay loam.	SC, CL	A-4, A-6	0	95-100	65-95	55-85	40-75	25-40	8-20
	29-60	Sand and gravel	SP, SP-SM, GP, GP-GM	A-1	0-5	40-75	35-70	20-40	0-10	---	NP
25----------------Lenawee	0-8	Silty clay loam	CL	A-6, A-7	0	100	95-100	90-100	50-95	25-45	11-22
	8-26	Silty clay loam, silty clay, clay.	CL, CH	A-6, A-7	0	100	95-100	90-100	80-95	25-55	11-30
	26-60	Stratified silt to silty clay.	CL, CL-ML	A-6, A-4, A-7	0	100	95-100	95-100	85-95	25-45	6-22
26A---------------Pipestone	0-11	Sand-------------	SP, SM, SP-SM	A-2-4, A-3	0	95-100	90-100	60-80	0-20	---	NP
	11-31	Sand, loamy sand, fine sand.	SP-SM, SP, SM	A-2-4, A-3	0	95-100	90-100	60-80	0-15	---	NP
	31-60	Sand, fine sand	SP-SM, SP	A-3, A-2-4	0	95-100	90-100	50-80	0-10	---	NP
27B, 27C---------Tustin	0-36	Loamy fine sand, fine sand.	SM	A-2	0	100	100	60-100	15-25	---	NP
	36-60	Silty clay, silty clay loam, clay.	CL, CH	A-7, A-6	0-5	90-100	90-100	85-100	65-100	30-80	15-50

See footnote at end of table.

TABLE 17.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
28B--------------- Rimer	0-9	Loamy fine sand	SM, ML	A-2, A-4, A-1	0	100	95-100	45-80	15-55	---	NP
	9-32	Loamy fine sand, fine sand, loamy sand.	SM	A-2, A-4	0	100	95-100	75-90	20-40	---	NP
	32-60	Clay, silty clay, silty clay loam.	CH, CL	A-7	0	100	95-100	90-100	80-95	40-65	20-38
29--------------- Cohoctah	0-15	Sandy loam--------	ML, SM	A-4, A-2	0	100	100	65-95	30-75	<30	NP-6
	15-42	Loamy sand, fine sandy loam, silt loam.	ML, SM, SC, CL	A-4, A-2	0	95-100	80-100	70-90	30-70	<30	NP-10
	42-60	Loam, fine sand, loamy sand.	ML, SM, SC, CL	A-4, A-2	0	95-100	80-100	65-90	20-70	<30	NP-10
30--------------- Belleville	0-10	Loamy fine sand	SM	A-2	0	100	95-100	70-85	20-35	<20	NP-4
	10-30	Sand, loamy sand, loamy fine sand, sand.	SM	A-2	0-3	95-100	90-100	50-85	15-30	<20	NP-4
	30-60	Clay loam, silty clay loam.	CL	A-6, A-7	0-3	95-100	90-100	90-100	70-90	25-50	10-25
31A--------------- Kibbie	0-9	Loam--------------	ML	A-4, A-6	0	100	100	75-95	50-85	25-40	2-14
	9-32	Silt loam, silty clay loam, sandy clay loam.	CL, CL-ML, SC, SM-SC	A-4, A-6, A-7	0	90-100	85-100	80-100	35-90	25-45	6-25
	32-60	Stratified silty clay loam to fine sand.	ML, SM, SC, CL	A-4, A-2	0	100	95-100	70-95	30-80	<30	NP-10
32--------------- Pella	0-11	Silt loam---------	CL	A-6, A-7	0	100	95-100	85-100	70-95	25-50	15-30
	11-37	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	95-100	85-100	70-95	30-50	15-30
	37-60	Stratified loamy sand to silty clay loam.	SM-SC, SC, CL, CL-ML	A-2, A-4, A-6	0-5	90-100	80-100	50-100	30-85	20-35	7-20
33D, 33E--------- Morley	0-8	Silt loam---------	CL	A-6	0-5	95-100	95-100	90-100	85-95	25-40	10-20
	8-17	Silty clay loam, clay loam.	CL	A-6	0-10	95-100	90-100	85-95	80-90	27-40	15-25
	17-30	Silty clay, clay loam, clay.	CL, CH	A-6, A-7	0-10	95-100	90-100	85-95	80-90	35-55	15-30
	30-60	Silty clay loam, clay loam.	CL	A-6, A-7	0-10	95-100	90-100	85-95	80-90	30-45	10-25
34B--------------- Blount	0-9	Loam--------------	CL	A-6, A-4	0-5	95-100	95-100	90-100	80-95	25-40	8-20
	9-34	Silty clay loam, clay, clay loam.	CH, CL	A-7, A-6	0-5	95-100	90-100	90-100	80-95	35-60	15-35
	34-60	Silty clay loam, clay loam.	CL	A-6	0-10	90-100	90-100	80-100	70-90	25-40	10-25
35*: Aquents.											
Histosols.											
36--------------- Pewamo	0-15	Silt loam---------	ML, CL, CL-ML	A-4	0-5	95-100	90-100	85-95	60-85	20-35	3-10
	15-42	Clay loam, clay, silty clay loam.	CL, CH	A-6, A-7	0-5	95-100	90-100	90-100	75-95	35-55	15-30
	42-60	Clay loam, silty clay loam.	CL	A-6, A-7	0-5	95-100	90-100	90-100	70-90	30-45	14-25
37--------------- Granby	0-12	Loamy fine sand	SM	A-2	0	100	100	50-75	15-30	---	NP
	12-46	Sand, fine sand, loamy sand.	SP, SP-SM, SM	A-3, A-2	0	100	95-100	50-75	0-20	---	NP
	46-60	Sand, fine sand	SP, SP-SM	A-3, A-2	0	100	95-100	50-70	0-5	---	NP

See footnote at end of table.

TABLE 17.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
38--------------- Elvers	0-23	Silt loam---------	ML, CL, CL-ML	A-4	0	100	100	90-100	70-90	20-30	3-10
	23-60	Sapric material	Pt	A-8	0	---	---	---	---	---	---
42A-------------- Morocco	0-9	Loamy sand--------	SM, SM-SC	A-2-4	0	100	100	50-85	15-35	<20	NP-5
	9-60	Fine sand, sand	SM, SP-SM	A-3, A-2-4	0	100	80-100	50-85	5-25	---	NP
44A-------------- Coupee	0-15	Silt loam---------	CL, CL-ML	A-4, A-6	0	100	95-100	85-95	60-85	25-35	5-15
	15-35	Sandy loam, clay loam, sandy clay loam.	CL, SC	A-6	0	96-98	80-95	70-95	40-90	30-40	11-20
	35-55	Stratified loamy sand to sand.	SM, SP-SM	A-3, A-2-4	0-3	88-95	80-85	50-70	5-15	---	NP
	55-60	Gravelly sand-----	SW, GP, SW-SM, GP-GM	A-1-A	0-5	45-60	30-40	15-20	2-10	---	NP
51*: Houghton---------	0-60	Sapric material	Pt	A-8	0	---	---	---	---	---	---
Kerston----------	0-21	Sapric material	Pt	A-8	0	---	---	---	---	---	---
	21-23	Stratified fine sand to silty clay loam.	SM, ML	A-2, A-4, A-6, A-7	0	100	100	65-100	15-80	20-45	NP-15
	23-26	Sapric material	Pt	A-8	0	---	---	---	---	---	---
	26-60	Stratified fine sand to silty clay loam.	SM, ML, SP-SM	A-2, A-4, A-6, A-7	0	100	95-100	55-95	10-75	20-45	NP-15
52B-------------- Abscota	0-10	Sandy loam--------	SM, SM-SC, SC	A-2-4, A-4	0	95-100	95-100	60-70	30-40	<25	NP-10
	10-39	Sand--------------	SP, SM, SP-SM	A-2-4, A-1, A-3	0	95-100	95-100	45-65	0-15	---	NP
	39-60	Sand, coarse sand	SP-SM, SP	A-1, A-3, A-2-4	0	95-100	95-100	45-60	0-10	---	NP
55--------------- Edwards	0-22	Sapric material	Pt	A-8	0	---	---	---	---	---	---
	22-60	Marl--------------	---	---	0	100	95-100	80-90	60-80	---	---
56B, 56C--------- Martinsville	0-7	Fine sandy loam	SM, SC, SM-SC	A-4	0	100	90-100	65-80	35-45	<25	2-10
	7-32	Clay loam, silty clay loam, sandy clay loam.	CL, SC	A-4, A-6	0	100	90-100	65-90	40-90	20-35	8-20
	32-38	Fine sandy loam, sandy clay loam, loam.	SM, ML	A-2-4, A-4	0	100	90-100	60-80	30-60	30-40	2-8
	38-60	Stratified sand to sandy clay loam.	CL, SC, CL-ML, SM-SC	A-4	0	95-100	85-100	80-95	40-60	<25	4-9
57A-------------- Thetford	0-31	Loamy sand, fine sand.	SM	A-2, A-4	0	95-100	90-100	70-85	20-45	<20	NP-4
	31-60	Loamy fine sand, sandy loam, fine sand.	SM	A-2, A-4	0	95-100	90-100	60-80	20-40	<20	NP-4
60B-------------- Plainfield	0-5	Sand--------------	SP-SM, SM, SP	A-3, A-2, A-1	0	75-100	75-100	40-80	3-35	---	NP
	5-60	Sand--------------	SP	A-3, A-1, A-2	0	75-100	75-100	40-70	1-4	---	NP
61A-------------- Whitaker	0-10	Loam--------------	CL, CL-ML	A-4, A-6	0	100	95-100	80-100	60-90	22-33	4-12
	10-38	Clay loam, loamy sand, silty clay loam.	CL	A-6, A-7, A-4	0	100	95-100	70-100	25-80	20-47	10-26
	38-60	Stratified coarse sand to clay.	CL, SC, ML, SM	A-4	0	98-100	98-100	60-85	40-60	15-25	3-9

See footnote at end of table.

TABLE 17.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
62---------------- Poy	0-12	Silt loam--------	CL	A-4, A-6	0	100	100	85-100	60-90	25-35	9-15
	12-22	Silty clay, clay, silty clay loam.	CH, CL	A-7	0	100	100	90-100	70-100	40-90	20-60
	22-60	Loamy sand, fine sand, loamy fine sand.	SM, SP-SM	A-2, A-3, A-4	0	85-100	75-100	50-100	5-45	---	NP
63B, 63C--------- Metea	0-8	Loamy sand-------	SM	A-2-4	0	100	100	50-80	15-35	---	NP
	8-36	Loamy sand, loamy fine sand, sand.	SP-SM, SM	A-2-4	0	100	100	50-80	10-35	---	NP
	36-41	Clay loam, sandy clay loam, silty clay loam.	CL, SC	A-6, A-7	0	90-100	90-95	75-95	40-75	25-50	12-30
	41-60	Loam, silty clay loam, clay loam.	CL, CL-ML	A-4, A-6	0-3	85-95	80-90	75-90	50-75	25-40	5-18
64A--------------- Selfridge	0-32	Loamy sand-------	SM, SM-SC	A-2	0-5	95-100	95-100	70-85	20-35	<20	NP-5
	32-35	Sandy loam-------	SM, SC, SM-SC	A-2, A-4	0-5	95-100	95-100	65-80	25-45	15-30	NP-10
	35-60	Clay loam, loam, silty clay loam.	CL	A-6, A-7	0-5	95-100	90-100	85-100	60-90	25-50	10-25
65F*: Udorthents.											
Udipsamments.											
66A--------------- Landes Variant	0-10	Silt loam--------	ML, CL-ML	A-4	0	100	95-100	80-95	50-90	<22	NP-6
	10-40	Very fine sandy loam, silt loam, loam.	ML, CL-ML	A-4	0	100	95-100	80-95	60-90	21-28	4-9
	40-60	Silt loam, loam, fine sandy loam.	ML, CL-ML	A-4	0	100	95-100	80-95	50-90	<28	NP-9
67A--------------- Shoals	0-33	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	85-100	60-90	22-36	6-15
	33-47	Sandy loam, loamy very fine sand.	SM-SC, SC	A-2-4, A-4	0	100	100	60-70	25-40	20-30	NP-10
	47-60	Loamy fine sand, sand, gravelly sand.	SW-SM, SM	A-2, A-3	0	80-100	70-100	35-75	5-25	---	NP
68A*: Granby-----------	0-12	Loamy fine sand	SM	A-2	0	100	100	50-75	15-30	---	NP
	12-46	Sand, fine sand, loamy sand.	SP, SP-SM, SM	A-3, A-2	0	100	95-100	50-75	0-20	---	NP
	46-60	Sand, fine sand	SP, SP-SM	A-3, A-2	0	100	95-100	50-70	0-5	---	NP
Morocco----------	0-9	Loamy sand-------	SM, SM-SC	A-2-4	0	100	100	50-85	15-35	<20	NP-5
	9-60	Fine sand, sand	SM, SP-SM	A-3, A-2-4	0	100	80-100	50-85	5-25	---	NP
69B*: Plainfield------	0-5	Loamy sand-------	SM, SP-SM	A-2, A-4, A-1	0	75-100	75-100	40-90	12-40	---	NP
	5-60	Sand-------------	SP	A-3, A-1, A-2	0	75-100	75-100	40-70	1-4	---	NP
Urban land.											
70A*: Thetford---------	0-31	Loamy sand, fine sand.	SM	A-2, A-4	0	95-100	90-100	70-85	20-45	<20	NP-4
	31-60	Loamy fine sand, sandy loam, fine sand.	SM	A-2, A-4	0	95-100	90-100	60-80	20-40	<20	NP-4
Urban land.											
71*. Pits											

See footnote at end of table.

TABLE 17.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
72B*:											
Udipsamments.											
Udorthents.											
75B*:											
Rimer	0-9	Loamy fine sand	SM, ML	A-2, A-4, A-1	0	100	95-100	45-80	15-55	---	NP
	9-32	Loamy fine sand, fine sand, loamy sand.	SM	A-2, A-4	0	100	95-100	75-90	20-40	---	NP
	32-60	Clay, silty clay, silty clay loam.	CH, CL	A-7	0	100	95-100	90-100	80-95	40-65	20-38
Urban land.											
76*. Urban land											
77B*:											
Oshtemo	0-10	Sandy loam	SM, SM-SC	A-2, A-4	0	95-100	60-95	60-70	25-40	15-25	2-7
	10-33	Sandy loam, sandy clay loam.	SM, SC, SM-SC	A-2, A-4, A-6	0	95-100	60-95	60-85	25-45	12-30	2-16
	33-41	Loamy sand	SM, SP-SM	A-2	0	85-95	60-95	55-70	10-15	---	NP
	41-60	Stratified coarse sand to gravel.	SP-SM, GP, SP, GP-GM	A-1, A-2, A-3	0-5	40-90	35-85	20-60	0-10	---	NP
Urban land.											
78B*, 78C*, 78D*:											
Riddles	0-7	Loam	CL	A-4, A-6	0	95-100	85-95	80-90	60-75	20-35	8-15
	7-55	Sandy clay loam, clay loam, loam.	CL, SC	A-6	0	90-100	80-95	75-90	35-75	25-40	10-20
	55-63	Clay loam, sandy loam, loam.	CL, SM, SC, ML	A-4, A-6, A-2	0-3	85-95	80-90	50-90	30-70	15-30	2-15
Oshtemo	0-10	Sandy loam	SM, SM-SC	A-2, A-4	0	95-100	60-95	60-70	25-40	15-25	2-7
	10-33	Sandy loam, sandy clay loam.	SM, SC, SM-SC	A-2, A-4, A-6	0	95-100	60-95	60-85	25-45	12-30	2-16
	33-41	Loamy sand	SM, SP-SM	A-2	0	85-95	60-95	55-70	10-15	---	NP
	41-60	Stratified coarse sand to gravel.	SP-SM, GP, SP, GP-GM	A-1, A-2, A-3	0-5	40-90	35-85	20-60	0-10	---	NP
80*:											
Cohoctah	0-15	Sandy loam	ML, SM	A-4, A-2	0	100	100	65-95	30-75	<30	NP-6
	15-42	Loamy sand, fine sandy loam, silt loam.	ML, SM, SC, CL	A-4, A-2	0	95-100	80-100	70-90	30-70	<30	NP-10
	42-60	Loam, sandy loam, loamy sand.	ML, SM, SC, CL	A-4, A-2	0	95-100	80-100	65-90	20-70	<30	NP-10
Urban land.											
82B*:											
Oshtemo	0-10	Sandy loam	SM, SM-SC	A-2, A-4	0	95-100	60-95	60-70	25-40	15-25	2-7
	10-33	Sandy loam, sandy clay loam.	SM, SC, SM-SC	A-2, A-4, A-6	0	95-100	60-95	60-85	25-45	12-30	2-16
	33-41	Loamy sand	SM, SP-SM	A-2	0	85-95	60-95	55-70	10-15	---	NP
	41-60	Stratified coarse sand to gravel.	SP-SM, GP, SP, GP-GM	A-1, A-2, A-3	0-5	40-90	35-85	20-60	0-10	---	NP
Ockley	0-9	Loam	CL, ML, CL-ML	A-4, A-6	0	100	95-100	80-100	60-90	22-33	3-12
	9-45	Gravelly clay loam, gravelly sandy clay loam, sandy loam.	CL, SC, GC	A-6, A-7	0-2	70-85	45-75	40-70	35-55	30-50	15-30
	45-60	Stratified loamy sand to gravelly sand.	SP, SP-SM, GP, GP-GM	A-1	1-5	30-70	20-55	5-20	2-10	---	NP

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 18.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

[The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated]

Soil name and map symbol	Depth	Clay <2mm	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	G/cm^3	In/hr	In/in	pH					Pct
2*:											
Cohoctah--------	0-15	5-20	1.12-1.59	2.0-6.0	0.13-0.22	6.1-7.8	Low-----------	0.28	5	3	1-4
	15-42	5-27	1.48-1.80	2.0-6.0	0.12-0.20	6.1-8.4	Low-----------	0.28			
	42-60	2-25	1.46-1.95	2.0-6.0	0.08-0.20	6.1-8.4	Low-----------	0.28			
Abscota---------	0-10	4-18	1.14-1.60	2.0-6.0	0.12-0.15	6.1-6.5	Low-----------	0.17	5	3	.5-3
	10-39	0-10	1.20-1.59	6.0-20	0.05-0.07	6.1-7.8	Low-----------	0.17			
	39-60	0-10	1.20-1.47	6.0-20	0.05-0.07	6.1-8.4	Low-----------	0.17			
3*. Beaches											
4*. Dune land											
5--------------- Houghton	0-60	---	0.15-0.45	0.2-6.0	0.35-0.45	5.6-7.8	-------------	----	---	3	>70
6--------------- Adrian	0-26	---	0.30-0.55	0.2-6.0	0.35-0.45	5.1-7.8	-------------	----	---	3	55-75
	26-60	2-10	1.40-1.75	6.0-20	0.03-0.08	5.6-8.4	Low-----------	----			
7--------------- Palms	0-40	---	0.25-0.45	0.2-6.0	0.35-0.45	5.1-8.4	-------------	----	---	3	>75
	40-60	7-35	1.46-2.00	0.2-2.0	0.14-0.22	6.1-8.4	Low-----------	----			
10B, 10D, 10F---- Oakville	0-10	0-10	1.27-1.56	6.0->20	0.07-0.09	5.6-7.3	Low-----------	0.15	5	1	.5-2
	10-60	0-10	1.26-1.67	6.0->20	0.06-0.08	5.6-7.3	Low-----------	0.15			
11B, 11C, 11D, 11E------------ Oshtemo	0-10	2-10	1.14-1.60	2.0-6.0	0.10-0.15	5.1-6.5	Low-----------	0.24	5	3	.5-3
	10-33	10-22	1.20-1.59	2.0-6.0	0.12-0.19	5.1-6.5	Low-----------	0.24			
	33-41	5-15	1.20-1.59	6.0-20	0.06-0.08	5.1-7.3	Low-----------	0.17			
	41-60	0-15	1.20-1.47	>20	0.02-0.04	7.4-8.4	Low-----------	0.10			
12A, 12B, 12C, 12D------------ Ockley	0-9	11-22	1.30-1.45	0.6-2.0	0.20-0.24	5.6-6.5	Low-----------	0.37	5	5	.5-3
	9-45	20-35	1.40-1.55	0.6-2.0	0.12-0.14	5.6-6.5	Moderate-----	0.24			
	45-60	2-5	1.60-1.80	>20	0.02-0.04	7.4-8.4	Low-----------	0.10			
13B, 13C, 13D---- Spinks	0-10	2-15	1.14-1.60	6.0-20	0.08-0.10	5.1-7.3	Low-----------	0.17	5	2	2-4
	10-60	0-15	1.20-1.47	2.0-20	0.04-0.08	5.6-7.8	Low-----------	0.17			
14B, 14C, 14D, 14E------------ Riddles	0-7	8-16	1.30-1.50	0.6-2.0	0.20-0.24	6.1-7.3	Low-----------	0.32	5	5	.5-2
	7-55	18-35	1.40-1.60	0.6-2.0	0.16-0.18	5.1-7.3	Moderate-----	0.32			
	55-63	8-25	1.40-1.60	0.6-2.0	0.05-0.19	6.6-8.4	Low-----------	0.32			
15C-------------- Glynwood	0-7	16-27	1.25-1.50	0.6-2.0	0.20-0.24	5.6-7.3	Low-----------	0.43	3	6	1-3
	7-26	35-55	1.45-1.75	0.06-0.2	0.11-0.18	4.5-8.4	Moderate-----	0.32			
	26-60	27-36	1.65-1.82	0.06-0.2	0.06-0.10	7.4-8.4	Moderate-----	0.32			
16B-------------- Crosier	0-9	7-18	1.40-1.55	0.6-2.0	0.20-0.22	6.1-7.3	Low-----------	0.32	5	5	1-3
	9-46	18-35	1.40-1.60	0.2-0.6	0.15-0.19	5.6-7.3	Moderate-----	0.32			
	46-60	10-20	1.40-1.60	0.2-0.6	0.10-0.19	7.9-8.4	Low-----------	0.32			
17--------------- Rensselaer	0-10	18-27	1.30-1.45	0.2-0.6	0.20-0.24	6.6-7.3	Low-----------	0.28	5	5	2-6
	10-35	27-35	1.40-1.60	0.06-0.2	0.15-0.19	6.1-7.3	Moderate-----	0.28			
	35-47	25-35	1.40-1.60	0.06-0.2	0.16-0.18	7.4-7.8	Moderate-----	0.28			
	47-60	2-30	1.50-1.70	0.6-2.0	0.19-0.21	7.9-8.4	Low-----------	0.28			

See footnote at end of table.

TABLE 18.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay <2mm	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group	Organic matter
	In	Pct	G/cm3	In/hr	In/in	pH					Pct
19A------------- Brady	0-11	2-15	1.25-1.41	2.0-6.0	0.12-0.15	5.6-7.3	Low----------	0.20	5	3	1-4
	11-35	5-22	1.35-1.45	2.0-6.0	0.12-0.17	5.1-6.5	Low----------	0.20			
	35-48	5-20	1.25-1.50	2.0-20	0.08-0.10	5.1-6.5	Low----------	0.20			
	48-60	0-10	1.25-1.50	>20	0.02-0.04	6.6-8.4	Low----------	0.10			
20-------------- Gilford	0-11	10-20	1.50-1.70	2.0-6.0	0.13-0.15	5.6-7.3	Low----------	0.20	4	3	2-4
	11-33	8-17	1.60-1.80	2.0-6.0	0.12-0.14	5.6-7.3	Low----------	0.20			
	33-60	3-12	1.70-1.90	6.0-20	0.05-0.08	6.6-8.4	Low----------	0.15			
22A------------- Monitor	0-16	11-22	1.30-1.45	0.6-2.0	0.20-0.24	5.6-7.3	Low----------	0.32	5	5	1-3
	16-28	22-33	1.45-1.65	0.2-0.6	0.16-0.18	4.5-6.5	Low----------	0.32			
	28-55	20-33	1.40-1.65	0.2-0.6	0.15-0.19	6.1-8.4	Moderate-----	0.32			
	55-60	2-5	1.60-1.80	>20	0.02-0.04	7.9-8.4	Low----------	0.10			
23-------------- Sebewa	0-13	10-25	1.15-1.60	0.6-2.0	0.18-0.22	6.1-7.8	Low----------	0.24	4	5	1-4
	13-29	18-35	1.50-1.80	0.6-2.0	0.15-0.19	6.1-7.8	Low----------	0.24			
	29-60	0-3	1.55-1.75	6.0-20	0.02-0.04	7.4-8.4	Low----------	0.10			
25-------------- Lenawee	0-8	20-35	0.91-1.55	0.6-2.0	0.17-0.22	5.6-6.0	Moderate-----	0.28	4	7	2-5
	8-26	35-45	1.39-1.78	0.2-0.6	0.18-0.20	6.6-7.8	Moderate-----	0.28			
	26-60	18-40	1.51-1.80	0.6-2.0	0.18-0.22	7.4-7.8	Low----------	0.28			
26A------------- Pipestone	0-11	2-12	0.63-1.57	6.0-20	0.07-0.10	4.5-7.3	Low----------	0.17	5	2	3-4
	11-31	2-12	1.22-1.57	6.0-20	0.06-0.09	4.5-7.3	Low----------	0.17			
	31-60	2-12	1.22-1.57	>20	0.05-0.07	5.1-7.3	Low----------	0.17			
27B, 27C--------- Tustin	0-36	4-10	1.55-1.70	6.0-20	0.10-0.12	5.1-7.3	Low----------	0.17	4	2	.5-2
	36-60	35-60	1.65-1.95	0.06-0.2	0.10-0.16	5.6-8.4	High---------	0.37			
28B------------- Rimer	0-9	3-15	1.40-1.60	6.0-20	0.07-0.12	5.1-7.3	Low----------	0.17	4	2	1-3
	9-32	5-18	1.40-1.70	6.0-20	0.06-0.11	5.1-7.3	Low----------	0.17			
	32-60	35-55	1.50-1.82	<0.2	0.08-0.12	6.1-8.4	High---------	0.32			
29-------------- Cohoctah	0-15	5-20	1.12-1.59	2.0-6.0	0.13-0.22	6.1-7.8	Low----------	0.28	5	3	1-4
	15-42	5-27	1.48-1.80	2.0-6.0	0.12-0.20	6.1-8.4	Low----------	0.28			
	42-60	2-25	1.46-1.95	2.0-6.0	0.08-0.20	6.1-8.4	Low----------	0.28			
30-------------- Belleville	0-10	3-12	0.92-1.59	6.0-20	0.10-0.12	6.1-7.8	Low----------	0.17	5	2	.5-3
	10-30	2-12	1.45-1.73	6.0-20	0.06-0.10	6.1-8.4	Low----------	0.17			
	30-60	27-35	1.46-1.95	0.2-0.6	0.14-0.20	7.4-8.4	Moderate-----	0.32			
31A------------- Kibbie	0-9	5-25	1.43-1.73	0.6-2.0	0.16-0.24	5.6-7.3	Low----------	0.28	5	5	1-3
	9-32	5-35	1.44-1.81	0.6-2.0	0.17-0.22	5.6-7.3	Low----------	0.43			
	32-60	2-18	1.47-1.90	0.6-2.0	0.12-0.22	7.4-8.4	Low----------	0.43			
32-------------- Pella	0-11	18-27	1.15-1.35	0.6-2.0	0.22-0.24	6.1-7.8	Moderate-----	0.28	5	6	5-6
	11-37	21-35	1.20-1.45	0.6-2.0	0.21-0.24	7.4-8.4	Moderate-----	0.28			
	37-60	15-30	1.40-1.70	0.6-2.0	0.10-0.22	7.4-8.4	Low----------	0.28			
33D, 33E--------- Morley	0-8	22-27	1.35-1.60	0.6-2.0	0.20-0.24	5.1-6.5	Low----------	0.43	3	6	2-3
	8-17	27-40	1.50-1.70	0.2-0.6	0.18-0.20	5.1-6.5	Moderate-----	0.43			
	17-30	35-50	1.60-1.80	0.06-0.2	0.11-0.15	5.6-6.5	Moderate-----	0.43			
	30-60	27-40	1.60-1.90	0.2-0.6	0.07-0.12	6.6-8.4	Moderate-----	0.43			
34B------------- Blount	0-9	22-27	1.35-1.55	0.6-2.0	0.20-0.24	5.1-6.5	Low----------	0.43	3	6	2-3
	9-34	35-50	1.40-1.70	0.06-0.6	0.12-0.19	4.5-6.5	Moderate-----	0.43			
	34-60	30-35	1.60-1.85	0.06-0.6	0.07-0.10	7.4-8.4	Moderate-----	0.43			
35*:											
Aquents.											
Histosols.											
36-------------- Pewamo	0-15	18-27	0.91-1.55	0.6-2.0	0.20-0.22	6.1-7.3	Low----------	0.24	5	5	2-5
	15-42	35-50	1.39-1.78	0.2-0.6	0.12-0.20	6.1-7.8	Moderate-----	0.24			
	42-60	30-40	1.51-1.80	0.2-0.6	0.14-0.18	7.4-8.4	Moderate-----	0.24			

See footnote at end of table.

TABLE 18.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay <2mm	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	G/cm3	In/hr	In/in	pH					Pct
37--------------- Granby	0-12	2-14	0.92-1.59	6.0-20	0.10-0.12	5.6-7.3	Low-----------	0.17	5	2	4-6
	12-46	0-14	1.45-1.65	6.0-20	0.05-0.12	5.6-7.8	Low-----------	0.17			
	46-60	0-10	1.45-1.65	6.0-20	0.05-0.09	6.6-8.4	Low-----------	0.17			
38--------------- Elvers	0-23	7-14	1.35-1.55	0.6-2.0	0.20-0.22	6.1-7.8	Low-----------	0.28	5	5	1-2
	23-60	---	---	0.2-6.0	0.35-0.45	6.1-6.5	--------------	----			
42A-------------- Morocco	0-9	1-6	1.40-1.60	6.0-20	0.10-0.12	5.1-6.5	Low-----------	0.17	5	2	.5-2
	9-60	1-6	1.50-1.70	6.0-20	0.05-0.07	4.5-6.0	Low-----------	0.17			
44A-------------- Coupee	0-15	15-25	1.30-1.45	0.6-2.0	0.20-0.24	5.6-7.3	Low-----------	0.32	4	5	.5-2
	15-35	18-30	1.40-1.60	0.6-2.0	0.17-0.20	5.1-6.0	Low-----------	0.32			
	35-55	3-10	1.50-1.65	6.0-20	0.06-0.08	5.1-5.5	Low-----------	0.17			
	55-60	2-6	1.50-1.65	>20	0.04-0.06	5.1-5.5	Low-----------	0.10			
51*:											
Houghton---------	0-60	---	0.15-0.45	0.2-6.0	0.35-0.45	5.6-7.8	--------------	----	---	3	>70
Kerston----------	0-21	---	0.28-0.45	0.2-6.0	0.35-0.45	5.6-8.4	--------------	----	---	3	60-85
	21-23	0-10	1.45-1.73	0.6-20	0.08-0.20	5.6-8.4	Low-----------	----			
	23-26	---	0.12-0.25	0.2-6.0	0.35-0.45	5.6-8.4	--------------	----			
	26-60	0-10	1.56-1.74	0.6-20	0.06-0.20	5.6-8.4	Low-----------	----			
52B-------------- Abscota	0-10	4-18	1.14-1.60	2.0-6.0	0.12-0.15	6.1-6.5	Low-----------	0.17	5	3	.5-3
	10-39	0-10	1.20-1.59	6.0-20	0.05-0.07	6.1-7.8	Low-----------	0.17			
	39-60	0-10	1.20-1.47	6.0-20	0.05-0.07	6.1-8.4	Low-----------	0.17			
55--------------- Edwards	0-22	---	0.30-0.55	0.2-6.0	0.35-0.45	5.6-7.8	--------------	----	---	3	55-75
	22-60	---	---	---	---	7.4-8.4	--------------	----			
56B, 56C--------- Martinsville	0-7	7-16	1.35-1.50	0.6-2.0	0.16-0.18	5.6-7.3	Low-----------	0.24	5	3	1-3
	7-32	18-30	1.40-1.60	0.6-2.0	0.17-0.20	5.1-6.0	Moderate------	0.37			
	32-38	10-25	1.40-1.60	0.6-2.0	0.12-0.14	5.6-6.5	Low-----------	0.24			
	38-60	3-23	1.50-1.70	0.6-2.0	0.19-0.21	7.4-8.4	Low-----------	0.24			
57A-------------- Thetford	0-31	2-15	1.25-1.41	2.0-6.0	0.10-0.13	5.6-7.3	Low-----------	0.17	5	2	1-4
	31-60	8-18	1.35-1.45	2.0-6.0	0.08-0.13	5.6-7.8	Low-----------	0.17			
60B-------------- Plainfield	0-5	4-9	1.35-1.65	6.0-20	0.04-0.09	4.5-7.3	Low-----------	0.17	5	1	<1
	5-60	1-4	1.50-1.65	6.0-20	0.04-0.07	4.5-6.5	Low-----------	0.17			
61A-------------- Whitaker	0-10	8-17	1.30-1.45	0.6-2.0	0.20-0.24	5.6-7.3	Low-----------	0.37	5	5	1-3
	10-38	18-30	1.40-1.60	0.6-2.0	0.15-0.19	5.1-6.0	Moderate------	0.37			
	38-60	3-18	1.50-1.70	0.6-6.0	0.19-0.21	6.6-8.4	Low-----------	0.37			
62--------------- Poy	0-12	18-27	1.35-1.55	0.6-2.0	0.20-0.24	6.1-7.3	Low-----------	0.28	3	6	3-12
	12-22	35-85	1.55-1.65	<0.2	0.09-0.13	6.1-8.4	High----------	0.28			
	22-60	2-9	1.55-1.80	6.0-20	0.04-0.07	6.6-8.4	Low-----------	0.15			
63B, 63C--------- Metea	0-8	3-8	1.45-1.60	>20	0.10-0.12	5.6-7.3	Low-----------	0.17	5	2	.5-2
	8-36	2-10	1.50-1.70	>20	0.06-0.11	5.1-7.3	Low-----------	0.17			
	36-41	25-35	1.50-1.70	0.6-2.0	0.15-0.19	5.6-7.3	Moderate------	0.32			
	41-60	20-30	1.40-1.65	0.2-2.0	0.05-0.19	7.4-8.4	Low-----------	0.32			
64A-------------- Selfridge	0-32	2-15	1.25-1.41	6.0-20	0.10-0.12	5.6-7.3	Low-----------	0.15	5	2	1-4
	32-35	8-18	1.35-1.45	6.0-20	0.12-0.14	5.6-7.3	Low-----------	0.15			
	35-60	18-35	1.47-1.90	0.2-2.0	0.14-0.20	7.4-8.4	Moderate------	0.37			
~~65F*~~:											
Udorthents.											
Udipsamments.											
66A-------------- Landes Variant	0-10	4-12	1.10-1.60	0.6-2.0	0.15-0.22	6.6-7.8	Low-----------	0.32	5	5	1-3
	10-40	10-18	1.20-1.80	2.0-20	0.17-0.22	6.6-7.8	Low-----------	0.32			
	40-60	4-18	1.30-1.80	2.0-20	0.14-0.19	7.4-8.4	Low-----------	0.32			

See footnote at end of table.

TABLE 18.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay <2mm	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group	Organic matter
	In	Pct	G/cm3	In/hr	In/in	pH					Pct
67A---------------- Shoals	0-33	18-27	1.30-1.45	0.6-2.0	0.20-0.24	6.6-7.8	Low-----------	0.37	5	5	2-4
	33-47	10-20	1.40-1.60	0.6-6.0	0.11-0.13	6.6-7.8	Low-----------	0.37			
	47-60	5-10	1.40-1.60	2.0-6.0	0.03-0.09	6.6-7.8	Low-----------	0.17			
68A*:											
Granby-----------	0-12	2-14	0.92-1.59	6.0-20	0.10-0.12	5.6-7.3	Low-----------	0.17	5	2	4-6
	12-46	0-14	1.45-1.65	6.0-20	0.05-0.12	5.6-7.8	Low-----------	0.17			
	46-60	0-10	1.45-1.65	6.0-20	0.05-0.09	6.6-8.4	Low-----------	0.17			
Morocco----------	0-9	1-6	1.40-1.60	6.0-20	0.10-0.12	5.1-6.5	Low-----------	0.17	5	2	.5-2
	9-60	1-6	1.50-1.70	6.0-20	0.05-0.07	4.5-6.0	Low-----------	0.17			
69B*:											
Plainfield-------	0-5	5-15	1.35-1.65	2.0-6.0	0.09-0.12	4.5-7.3	Low-----------	0.17	5	2	<1
	5-60	1-4	1.50-1.65	6.0-20	0.04-0.07	4.5-6.5	Low-----------	0.17			
Urban land.											
70A*:											
Thetford---------	0-31	2-15	1.25-1.41	2.0-6.0	0.10-0.13	5.6-7.3	Low-----------	0.17	5	2	1-4
	31-60	8-18	1.35-1.45	2.0-6.0	0.08-0.13	5.6-7.8	Low-----------	0.17			
Urban land.											
71*. Pits											
72B*:											
Udipsamments.											
Udorthents.											
75B*:											
Rimer------------	0-9	3-15	1.40-1.60	6.0-20	0.07-0.12	5.1-7.3	Low-----------	0.17	4	2	1-3
	9-32	5-18	1.40-1.70	6.0-20	0.06-0.11	5.1-7.3	Low-----------	0.17			
	32-60	35-55	1.50-1.82	<0.2	0.08-0.12	6.1-8.4	High----------	0.32			
Urban land.											
76*. Urban land											
77B*:											
Oshtemo----------	0-10	2-10	1.14-1.60	2.0-6.0	0.10-0.15	5.1-6.5	Low-----------	0.24	5	3	.5-3
	10-33	10-22	1.20-1.59	2.0-6.0	0.12-0.19	5.1-6.5	Low-----------	0.24			
	33-41	5-15	1.20-1.59	6.0-20	0.06-0.08	5.1-7.3	Low-----------	0.17			
	41-60	0-15	1.20-1.47	>20	0.02-0.04	7.4-8.4	Low-----------	0.10			
Urban land.											
78B*, 78C*, 78D*:											
Riddles----------	0-7	8-16	1.30-1.50	0.6-2.0	0.20-0.24	6.1-7.3	Low-----------	0.32	5	5	.5-2
	7-55	18-35	1.40-1.60	0.6-2.0	0.16-0.18	5.1-7.3	Moderate------	0.32			
	55-63	8-25	1.40-1.60	0.6-2.0	0.05-0.19	6.6-8.4	Low-----------	0.36			
Oshtemo----------	0-10	2-10	1.14-1.60	2.0-6.0	0.10-0.15	5.1-6.5	Low-----------	0.24	5	3	.5-3
	10-33	10-22	1.20-1.59	2.0-6.0	0.12-0.19	5.1-6.5	Low-----------	0.24			
	33-41	5-15	1.20-1.59	6.0-20	0.06-0.08	5.1-7.3	Low-----------	0.17			
	41-60	0-15	1.20-1.47	>20	0.02-0.04	7.4-8.4	Low-----------	0.10			
80*:											
Cohoctah---------	0-15	5-20	1.12-1.59	2.0-6.0	0.13-0.22	6.1-7.8	Low-----------	0.28	5	3	1-4
	15-42	5-27	1.48-1.80	2.0-6.0	0.12-0.20	6.1-8.4	Low-----------	0.28			
	42-60	2-25	1.46-1.95	2.0-6.0	0.08-0.20	6.1-8.4	Low-----------	0.28			

See footnote at end of table.

TABLE 18.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay <2mm	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group	Organic matter
	In	Pct	G/cm3	In/hr	In/in	pH					Pct
80*:											
Urban land.											
82B*:											
Oshtemo----------	0-10	2-10	1.14-1.60	2.0-6.0	0.10-0.15	5.1-6.5	Low-----------	0.24	5	3	.5-3
	10-33	10-22	1.20-1.59	2.0-6.0	0.12-0.19	5.1-6.5	Low-----------	0.24			
	33-41	5-15	1.20-1.59	6.0-20	0.06-0.08	5.1-7.3	Low-----------	0.17			
	41-60	0-15	1.20-1.47	>20	0.02-0.04	7.4-8.4	Low-----------	0.10			
Ockley-----------	0-9	11-22	1.30-1.45	0.6-2.0	0.20-0.24	5.6-6.5	Low-----------	0.37	5	5	.5-3
	9-45	20-35	1.40-1.55	0.6-2.0	0.12-0.14	5.6-6.5	Moderate-----	0.24			
	45-60	2-5	1.60-1.80	>20	0.02-0.04	7.4-8.4	Low-----------	0.10			

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 19.--SOIL AND WATER FEATURES

[The symbol > means more than. Absence of an entry indicates that the feature is not a conc

Soil name and map symbol	Hydrologic group	Flooding			High water table			Subsidence	Potential frost action	
		Frequency	Duration	Months	Depth	Kind	Months	Total		U
					Ft			In		
2*:										
Cohoctah----------	B/D	Occasional	Brief to long.	Jan-Dec	0-1.0	Apparent	Sep-May	---	High-----	H
Abscota-----------	A	Occasional	Brief-----	Mar-Jun	2.5-5.0	Apparent	Dec-May	---	Low------	L
3*. Beaches										
4*. Dune land										
5----------------- Houghton	A/D	None---------	---	---	+1-1.0	Apparent	Sep-Jun	55-60	High-----	H
6----------------- Adrian	A/D	None---------	---	---	+1-1.0	Apparent	Nov-May	29-33	High-----	H
7----------------- Palms	A/D	None---------	---	---	+1-1.0	Apparent	Nov-May	25-32	High-----	H
10B, 10D, 10F----- Oakville	A	None---------	---	---	>6.0	---	---	---	Low------	L
11B, 11C, 11D, 11E-------------- Oshtemo	B	None---------	---	---	>6.0	---	---	---	Low------	L
12A, 12B, 12C, 12D-------------- Ockley	B	None---------	---	---	>6.0	---	---	---	Moderate	M
13B, 13C, 13D----- Spinks	A	None---------	---	---	>6.0	---	---	---	Low------	L
14B, 14C, 14D, 14E-------------- Riddles	B	None---------	---	---	>6.0	---	---	---	Moderate	M
15C--------------- Glynwood	C	None---------	---	---	2.0-3.5	Perched	Jan-Apr	---	High-----	H
16B--------------- Crosier	C	None---------	---	---	1.0-3.0	Apparent	Jan-Apr	---	High-----	H
17---------------- Rensselaer	B/D	None---------	---	---	+.5-1.0	Apparent	Dec-May	---	High-----	H
19A--------------- Brady	B	None---------	---	---	1.0-3.0	Apparent	Nov-May	---	High-----	L

See footnote at end of table.

TABLE 19.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Subsidence	Potential frost action
		Frequency	Duration	Months	Depth	Kind	Months	Total	
					Ft			In	
20---------------- Gilford	B/D	None---------	---	---	+.5-1.0	Apparent	Dec-May	---	High-----
22A--------------- Monitor	C	None---------	---	---	1.0-3.0	Apparent	Jan-Apr	---	High-----
23---------------- Sebewa	B/D	None---------	---	---	+1-1.0	Apparent	Sep-May	---	High-----
25---------------- Lenawee	B/D	None---------	---	---	+1-1.0	Apparent	Nov-May	---	High-----
26A--------------- Pipestone	A	None---------	---	---	0.5-1.5	Apparent	Oct-Jun	---	Moderate
27B, 27C---------- Tustin	B	None---------	---	---	>6.0	---	---	---	Moderate
28B--------------- Rimer	C	None---------	---	---	1.0-2.5	Perched	Jan-Apr	---	High-----
29---------------- Cohoctah	B/D	Frequent----	Brief to long.	Jan-Dec	0-1.0	Apparent	Sep-May	---	High-----
30---------------- Belleville	B/D	None---------	---	---	+1-1.0	Apparent	Mar-May	---	High-----
31A--------------- Kibbie	B	None---------	---	---	1.0-2.0	Apparent	Nov-May	---	High-----
32---------------- Pella	B/D	None---------	---	---	+1-2.0	Apparent	Mar-Jun	---	High-----
33D, 33E---------- Morley	C	None---------	---	---	3.0-6.0	Perched	Mar-May	---	Moderate
34B--------------- Blount	C	None---------	---	---	1.0-3.0	Perched	Jan-May	---	High-----
35*: Aquents.									
Histosols.									
36---------------- Pewamo	C/D	None---------	---	---	+1-1.0	Apparent	Dec-May	---	High-----
37---------------- Granby	A/D	None---------	---	---	+1-1.0	Apparent	Nov-Jun	---	Moderate
38---------------- Elvers	B/D	None---------	---	---	+1-1.0	Apparent	Nov-May	---	High-----

See footnote at end of table.

TABLE 19.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Subsidence	Potential frost action
		Frequency	Duration	Months	Depth	Kind	Months	Total	
					Ft			In	
42A----------------- Morocco	B	None---------	---	---	1.0-3.0	Apparent	Jan-Apr	---	Moderate
44A----------------- Coupee	B	None---------	---	---	>6.0	---	---	---	Low------
51*: Houghton----------	A/D	None---------	---	---	+1-1.0	Apparent	Sep-Jun	55-60	High-----
Kerston-----------	A/D	Frequent-----	Long------	Mar-May	+1-1.0	Apparent	Sep-Jun	18-20	High-----
52B----------------- Abscota	A	Occasional	Brief-----	Mar-Jun	2.5-5.0	Apparent	Dec-May	---	Low------
55----------------- Edwards	B/D	None---------	---	---	+1-0.5	Apparent	Sep-Jun	25-30	High-----
56B, 56C----------- Martinsville	B	None---------	---	---	>6.0	---	---	---	Moderate
57A----------------- Thetford	A	None---------	---	---	1.0-2.0	Apparent	Feb-May	---	Moderate
60B----------------- Plainfield	A	None---------	---	---	>6.0	---	---	---	Low------
61A----------------- Whitaker	C	None---------	---	---	1.0-3.0	Apparent	Jan-Apr	---	High-----
62----------------- Poy	D	None---------	---	---	+1-1.0	Perched	Nov-May	---	High-----
63B, 63C----------- Metea	B	None---------	---	---	>6.0	---	---	---	Moderate
64A----------------- Selfridge	C	None---------	---	---	1.0-2.0	Apparent	Nov-May	---	High-----
65F*: Udorthents.									
Udipsamments.									
66A----------------- Landes Variant	B	Rare---------	---	---	3.0-6.0	Apparent	Mar-May	---	High-----
67A----------------- Shoals	C	Occasional	Brief-----	Mar-Jun	1.0-3.0	Apparent	Jan-Apr	---	High-----
68A*: Granby------------	A/D	None---------	---	---	+1-1.0	Apparent	Nov-Jun	---	Moderate
Morocco-----------	B	None---------	---	---	1.0-3.0	Apparent	Jan-Apr	---	Moderate

See footnote at end of table.

TABLE 19.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Subsidence	Potential frost action
		Frequency	Duration	Months	Depth	Kind	Months	Total	
					Ft			In	
69B*:									
Plainfield	A	None	---	---	>6.0	---	---	---	Low
Urban land.									
70A*:									
Thetford	A	None	---	---	1.0-2.0	Apparent	Feb-May	---	Moderate
Urban land.									
71*. Pits									
72B*:									
Udipsamments.									
Udorthents.									
75B*:									
Rimer	C	None	---	---	0.5-2.0	Perched	Jan-Apr	---	High
Urban land.									
76*. Urban land									
77B*:									
Oshtemo	B	None	---	---	>6.0	---	---	---	Low
Urban land.									
78B*, 78C*, 78D*:									
Riddles	B	None	---	---	>6.0	---	---	---	Moderate
Oshtemo	B	None	---	---	>6.0	---	---	---	Low
80*:									
Cohoctah	B/D	Frequent	Brief to long.	Jan-Dec	0-1.0	Apparent	Sep-May	---	High
Urban land.									
82B*:									
Oshtemo	B	None	---	---	>6.0	---	---	---	Low
Ockley	B	None	---	---	>6.0	---	---	---	Moderate

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 20.--CLASSIFICATION OF THE SOILS

[An asterisk in the first column indicates that the soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series]

Soil name	Family or higher taxonomic class
*Abscota	Mixed, mesic Typic Udipsamments
Adrian	Sandy or sandy-skeletal, mixed, euic, mesic Terric Medisaprists
Aquents	Mixed, nonacid, mesic Aquents
Belleville	Sandy over loamy, mixed, mesic Typic Haplaquolls
Blount	Fine, illitic, mesic Aeric Ochraqualfs
Brady	Coarse-loamy, mixed, mesic Aquollic Hapludalfs
Cohoctah	Coarse-loamy, mixed, mesic Fluvaquentic Haplaquolls
Coupee	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Ultic Hapludalfs
*Crosier	Fine-loamy, mixed, mesic Aeric Ochraqualfs
Edwards	Marly, euic, mesic Limnic Medisaprists
Elvers	Coarse-silty, mixed, nonacid, mesic Thapto-Histic Fluvaquents
Gilford	Coarse-loamy, mixed, mesic Typic Haplaquolls
*Glynwood	Fine, illitic, mesic Aquic Hapludalfs
Granby	Sandy, mixed, mesic Typic Haplaquolls
Histosols	Euic, mesic Histosols
Houghton	Euic, mesic Typic Medisaprists
Kerston	Euic, mesic Fluvaquentic Medisaprists
*Kibbie	Fine-loamy, mixed, mesic Aquollic Hapludalfs
Landes Variant	Coarse-silty, mixed, mesic Fluventic Hapludolls
Lenawee	Fine, mixed, nonacid, mesic Mollic Haplaquepts
Martinsville	Fine-loamy, mixed, mesic Typic Hapludalfs
Metea	Loamy, mixed, mesic Arenic Hapludalfs
*Monitor	Fine-loamy, mixed, mesic Udollic Ochraqualfs
Morley	Fine, illitic, mesic Typic Hapludalfs
Morocco	Mixed, mesic Aquic Udipsamments
Oakville	Mixed, mesic Typic Udipsamments
Ockley	Fine-loamy, mixed, mesic Typic Hapludalfs
Oshtemo	Coarse-loamy, mixed, mesic Typic Hapludalfs
Palms	Loamy, mixed, euic, mesic Terric Medisaprists
Pella	Fine-silty, mixed, mesic Typic Haplaquolls
*Pewamo	Fine, mixed, mesic Typic Argiaquolls
Pipestone	Sandy, mixed, mesic Entic Haplaquods
Plainfield	Mixed, mesic Typic Udipsamments
Poy	Clayey over sandy or sandy-skeletal, mixed, mesic Typic Haplaquolls
Rensselaer	Fine-loamy, mixed, mesic Typic Argiaquolls
Riddles	Fine-loamy, mixed, mesic Typic Hapludalfs
*Rimer	Loamy, mixed, mesic Aquic Arenic Hapludalfs
Sebewa	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Typic Argiaquolls
Selfridge	Loamy, mixed, mesic Aquic Arenic Hapludalfs
Shoals	Fine-loamy, mixed, nonacid, mesic Aeric Fluvaquents
Spinks	Sandy, mixed, mesic Psammentic Hapludalfs
*Thetford	Sandy, mixed, mesic Psammaquentic Hapludalfs
Tustin	Clayey, mixed, mesic Arenic Hapludalfs
Udipsamments	Mixed, mesic Udipsamments
Udorthents	Loamy, mixed, nonacid, mesic Udorthents
Whitaker	Fine-loamy, mixed, mesic Aeric Ochraqualfs

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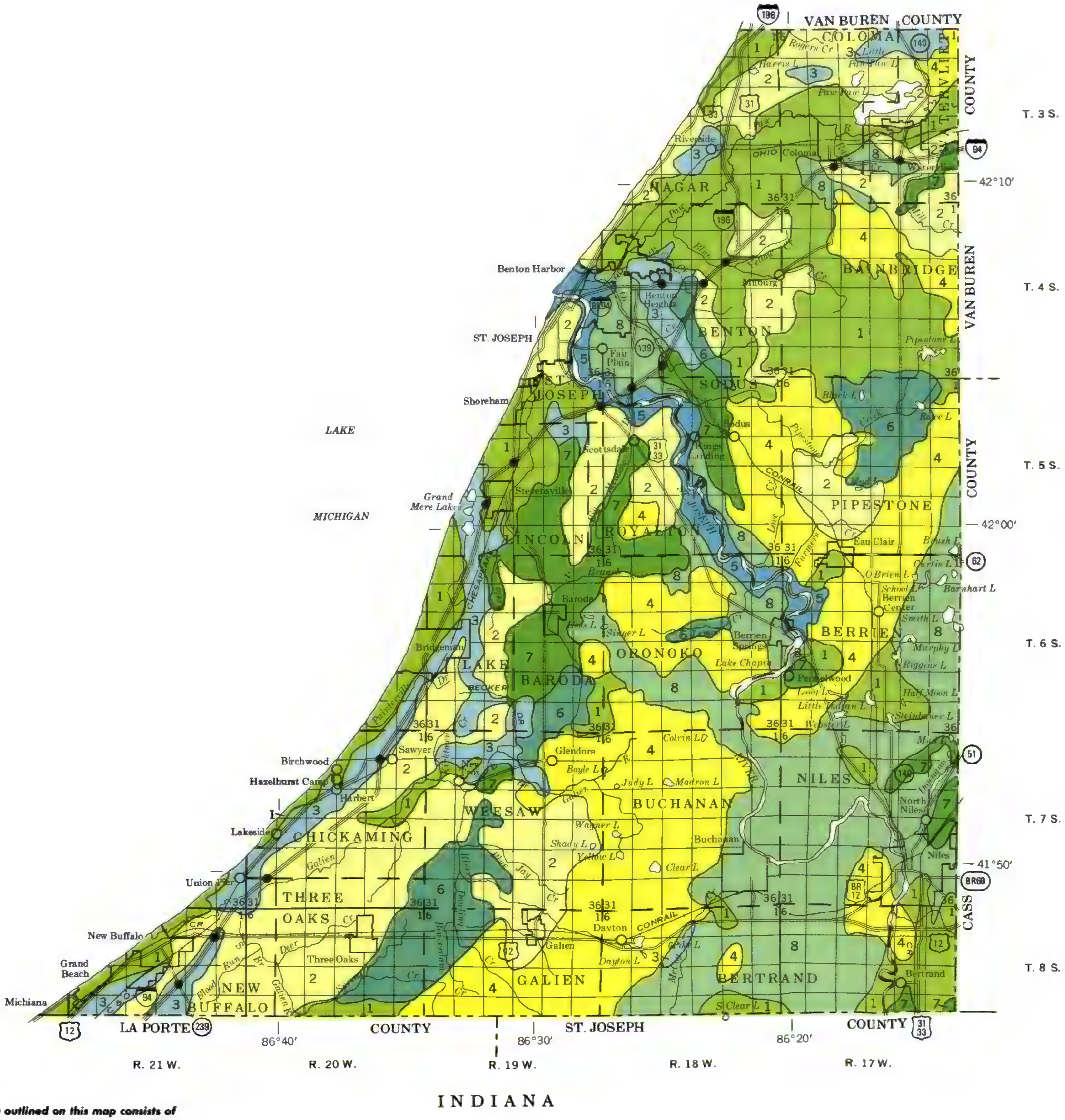
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
MICHIGAN AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP

BERRIEN COUNTY, MICHIGAN

Scale 1: 253,440



SOIL LEGEND*

1 Spinks-Oakville-Oshtemo association: Nearly level to very steep, well drained, sandy and loamy soils on moraines, till plains, outwash plains, and beach ridges

2 Blount-Rimer association: Nearly level and gently sloping, somewhat poorly drained, loamy and sandy soils on till plains and moraines

3 Morocco-Thetford-Granby association: Nearly level, somewhat poorly drained and poorly drained, sandy soils on moraines, till plains, outwash plains, lake plains, and beach ridges

4 Riddles-Ockley-Oshtemo association: Nearly level to very steep, well drained, loamy soils on outwash plains, moraines, and till plains

5 Shoals-Cohoctah-Abscota association: Nearly level and gently sloping, poorly drained to moderately well drained, silty and loamy soils on flood plains

6 Pella-Kibbie association: Nearly level, poorly drained and somewhat poorly drained, silty and loamy soils on outwash plains, lake plains, and deltas

7 Brady-Monitor-Gilford association: Nearly level, somewhat poorly drained and very poorly drained, loamy soils on outwash plains, deltas, and lake plains

8 Ockley-Oshtemo association: Nearly level to steep, well drained, loamy soils on outwash plains and moraines

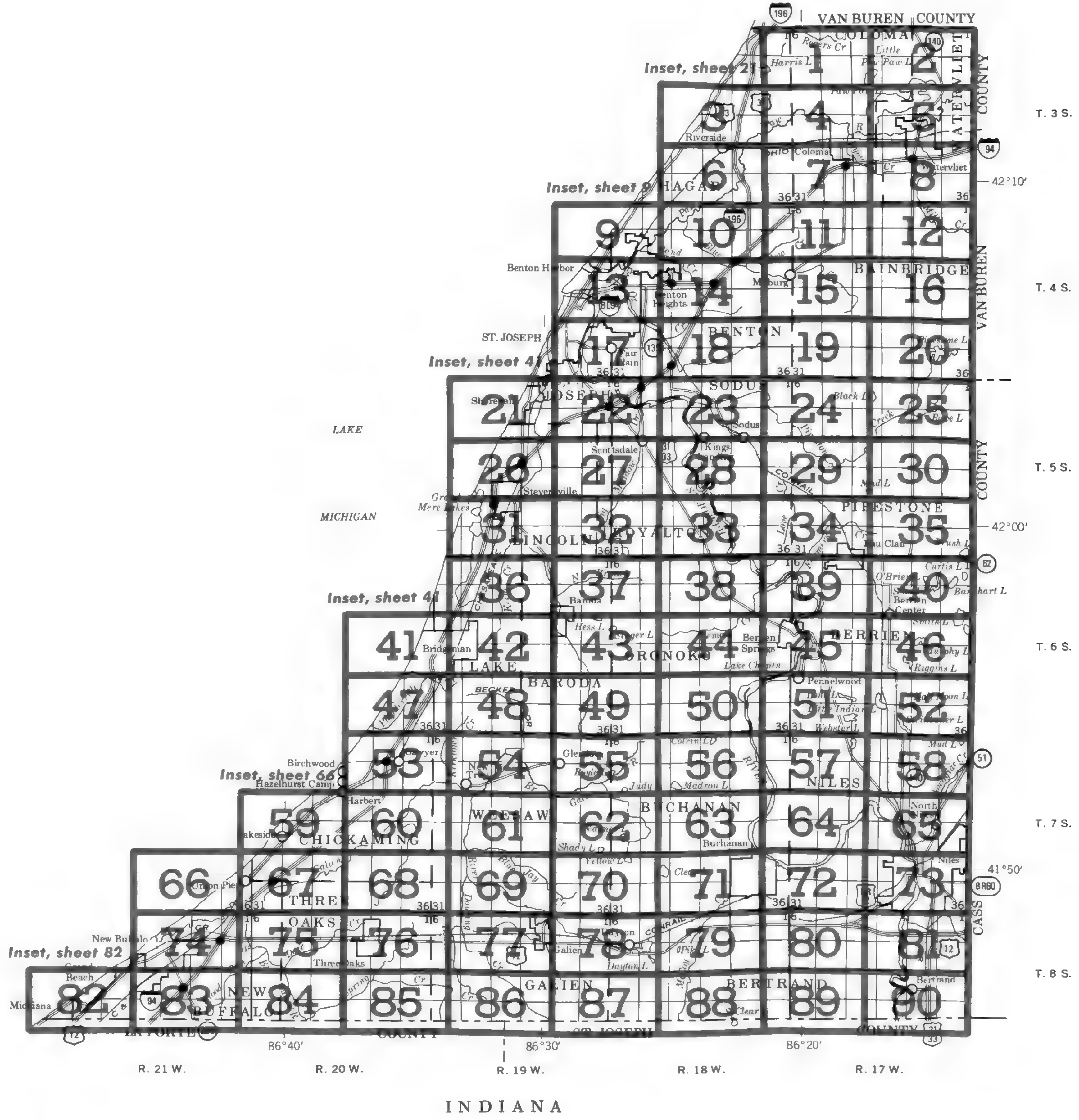
*Texture terms in the descriptive headings refer to the surface layer of the major soils in the associations.

Compiled 1979

SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.



VAN BUREN COUNTY
VAN BUREN COUNTY
CASS
INDIANA
LAKE MICHIGAN
T. 3 S.
T. 4 S.
T. 5 S.
T. 6 S.
T. 7 S.
T. 8 S.
R. 21 W.
R. 20 W.
R. 19 W.
R. 18 W.
R. 17 W.
42°10′
42°00′
41°50′
86°40′
86°30′
86°20′
Inset, sheet 21
Inset, sheet 9
Inset, sheet 41
Inset, sheet 41
Inset, sheet 66
Inset, sheet 82
COLOMA
WATERVLIET
HAGAR
BAINBRIDGE
BENTON
SODUS
ST. JOSEPH
LINCOLN
ROYALTON
PIPESTONE
BERRIEN
ORONOKO
LAKE
BARODA
BUCHANAN
NILES
WEESAW
CHICKAMING
THREE OAKS
NEW BUFFALO
GALIEN
BERTRAND
LA PORTE
COUNTY
ST. JOSEPH
Benton Harbor
Riverside
Coloma
Watervliet
Benton Heights
Fair Plain
Shoreham
Stevensville
Scottsdale
Sodus
Bridgman
Baroda
Berrien Springs
Pennelwood
Berrien Center
Eau Claire
Birchwood
Hazelhurst Camp
Harbert
Lakeside
Union Pier
New Buffalo
Grand Beach
Michiana
Three Oaks
Galien
Buchanan
Niles
Bertrand
Glendora
Sawyer
Grand Mere Lakes

sent the kind of soil.
r are for nearly level

NAME

12 to 18 percent slopes
18 to 25 percent slopes
4 percent slopes
sols, ponded

sand

nd, 0 to 2 percent slopes
0 to 3 percent slopes
mucks
m, 0 to 6 percent slopes

sandy loam, 2 to 6 percent slopes
sandy loam, 6 to 12 percent slopes
nd, 0 to 2 percent slopes
to 6 percent slopes
o 2 percent slopes

1 to 6 percent slopes
, 6 to 12 percent slopes
and, 0 to 3 percent slopes
dipsamments, 18 to 90 percent slopes
lt loam, 0 to 3 percent slopes
0 to 2 percent slopes
complex, 0 to 3 percent slopes
land complex, 0 to 6 percent slopes
and complex, 0 to 3 percent slopes

d Udorthents, 0 to 6 percent slopes
complex, 0 to 4 percent slopes

nd complex, 0 to 6 percent slopes
complex, 1 to 6 percent slopes
complex, 6 to 12 percent slopes
complex, 12 to 18 percent slopes
land complex
complex, 0 to 4 percent slopes

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- National, state or province
- County or parish
- Minor civil division
- Reservation (national forest or park, state forest or park, and large airport)
- Land grant
- Limit of soil survey (label)
- Field sheet matchline & neatline

AD HOC BOUNDARY (label)

- Small airport, airfield, park, oilfield, cemetery, or flood pool (Davis Airstrip; FLOOD POOL LINE)

STATE COORDINATE TICK

LAND DIVISION CORNERS (sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads
- Trail

ROAD EMBLEMS & DESIGNATIONS

- Interstate (79)
- Federal (410)
- State (52)
- County, farm or ranch (378)

RAILROAD

POWER TRANSMISSION LINE (normally not shown)

PIPE LINE (normally not shown)

FENCE (normally not shown)

LEVEES

- Without road
- With road
- With railroad

DAMS

- Large (to scale)
- Medium or small (water; w)

PITS

- Gravel pit
- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas)
- Church
- School
- Indian mound (label) (Indian Mound)
- Located object (label) (Tower)
- Tank (label) (GAS)
- Wells, oil or gas
- Windmill
- Kitchen midden

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
  - Double-line (label) (CANAL)
  - Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial (water; w)
- Intermittent (int; i)

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Spring
- Well, artesian
- Well, irrigation
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS (29; 78B)

ESCARPMENTS

- Bedrock (points down slope)
- Other than bedrock (points down slope)

SHORT STEEP SLOPE

GULLY

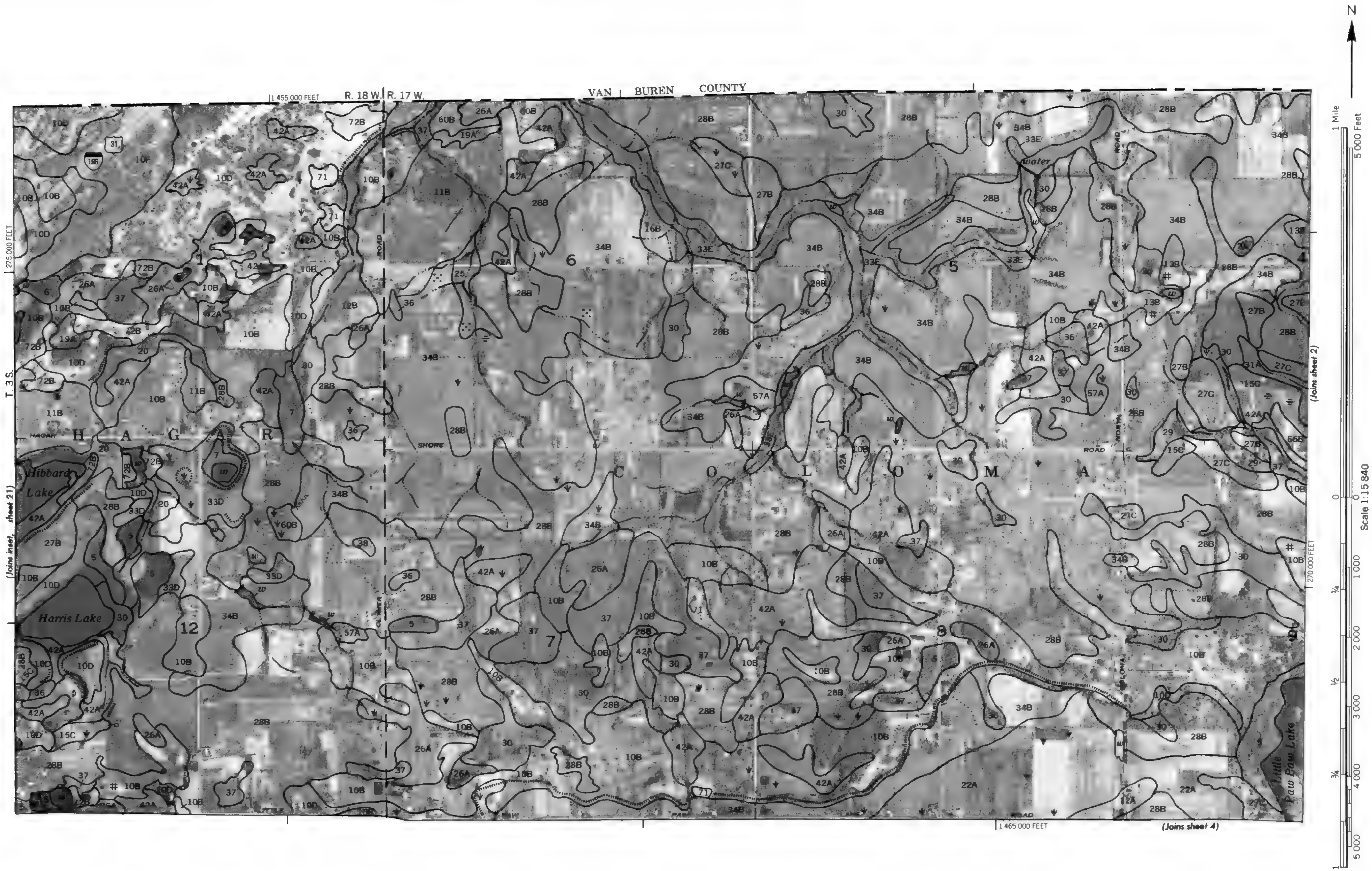
DEPRESSION OR SINK

SOIL SAMPLE SITE (normally not shown) (S)

MISCELLANEOUS

- Blowout
- Clay spot
- Gravelly spot
- Gumbo, slick or scabby spot (sodic)
- Dumps and other similar non soil areas
- Prominent hill or peak
- Rock outcrop (includes sandstone and shale)
- Saline spot
- Sandy spot
- Severely eroded spot
- Slide or slip (tips point upslope)
- Stony spot, very stony spot
- Sanitary landfill up to 10 acres in size
- Overwash material up to 3 acres in size
- Loamy spot up to 3 acres in size
- Wind eroded spot up to 3 acres in size

1



BERRIEN COUNTY, MICHIGAN NO. 1

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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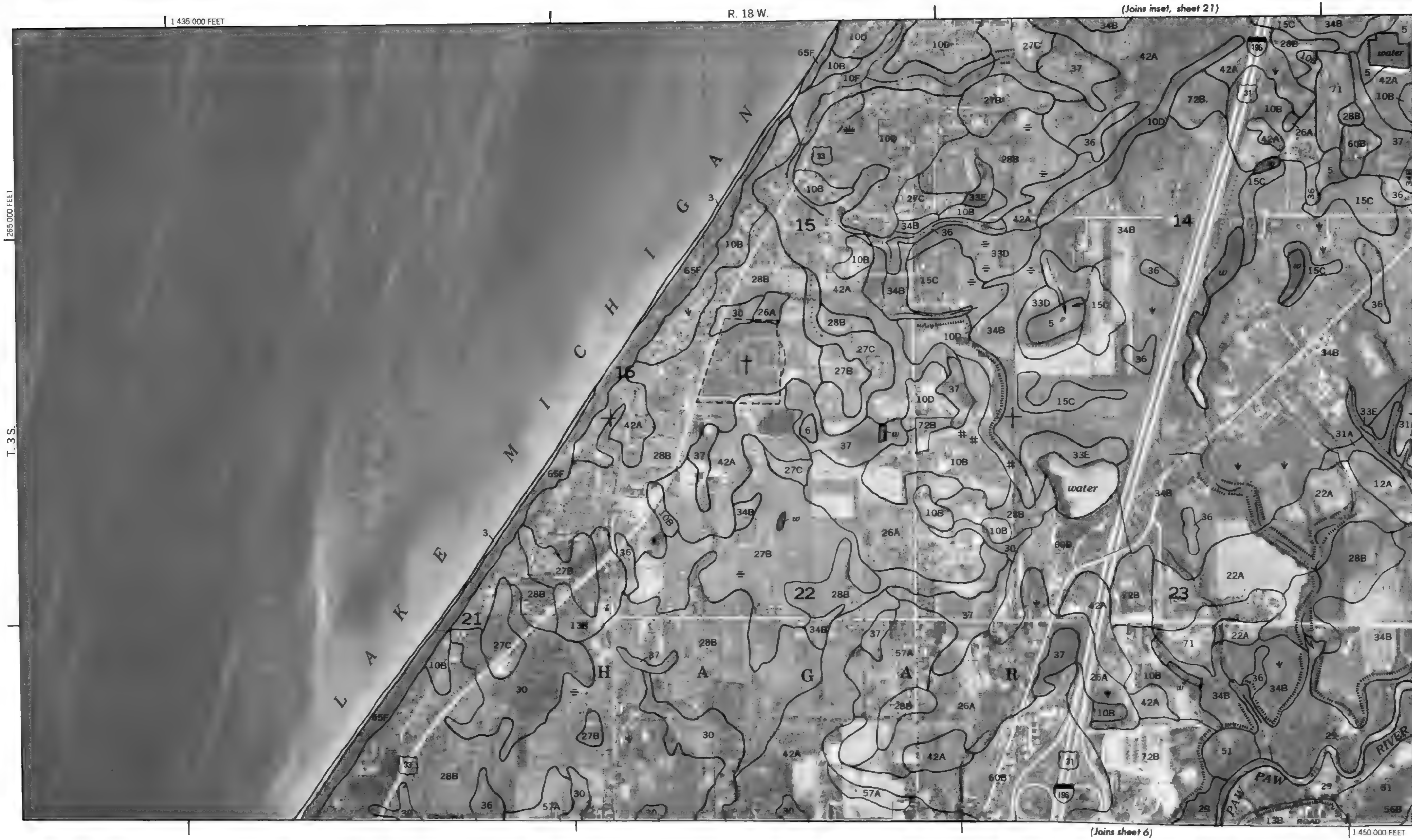
BERRIEN COUNTY, MICHIGAN NO. 2

(3)

N



1 Mile
5 000 Feet
Scale 1:15 840
0 ¼ ½ ¾ 1
0 1 000 2 000 3 000 4 000 5 000

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BERRIEN COUNTY, MICHIGAN NO. 3

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BERRIEN COUNTY, MICHIGAN NO. 5

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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BERRIEN COUNTY, MICHIGAN NO. 6

(7)

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

BERRIEN COUNTY, MICHIGAN NO. 7

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
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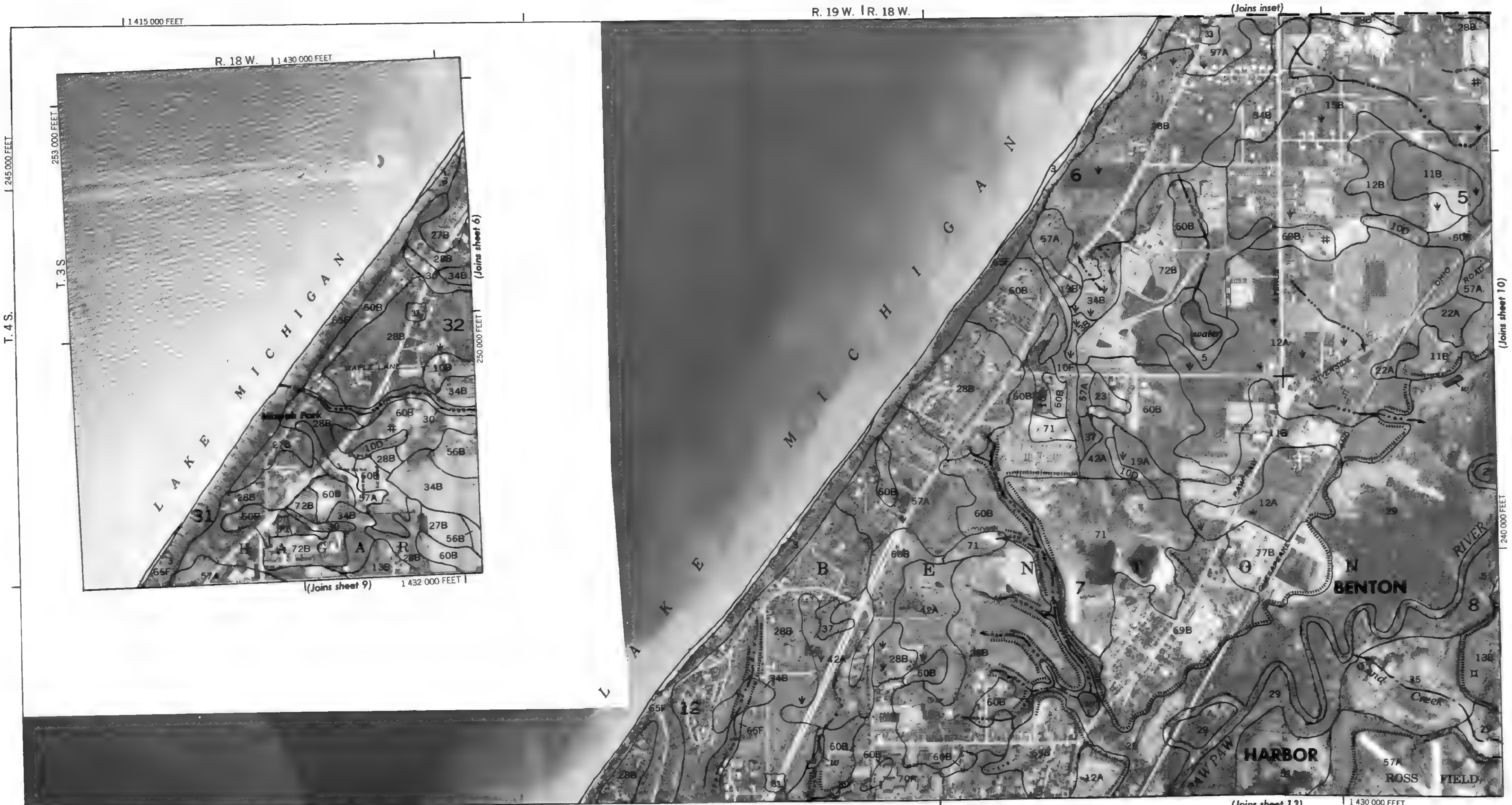
BERRIEN COUNTY, MICHIGAN NO. 8



N

1 Mile
5 000 Feet
Scale 1:15 840
0 1 000 2 000 3 000 4 000 5 000
0 ¼ ½ ¾ 1

BERRIEN COUNTY, MICHIGAN NO. 9

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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BERRIEN COUNTY, MICHIGAN NO. 10

BERRIEN COUNTY, MICHIGAN NO. 11

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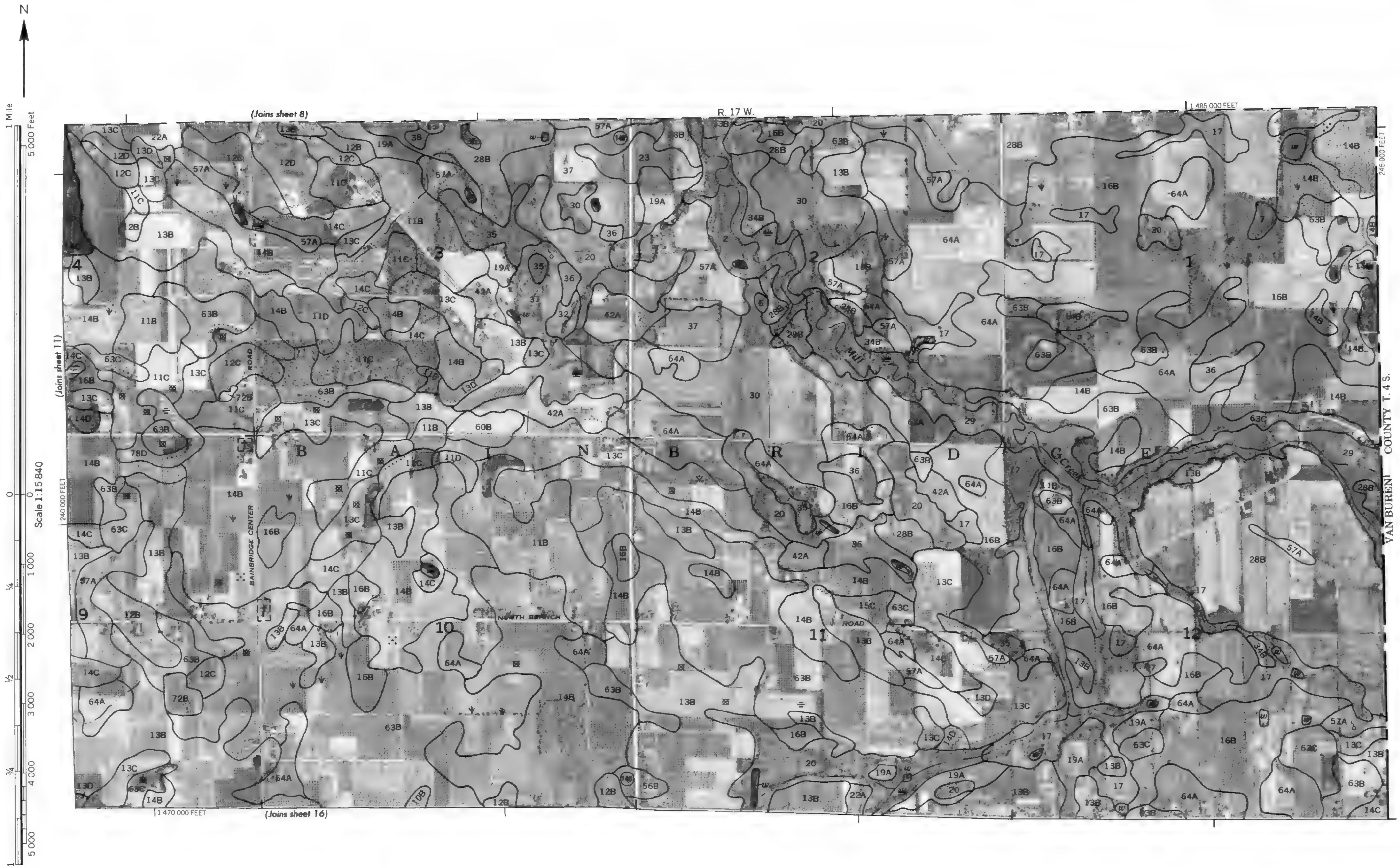

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned

BERRIEN COUNTY, MICHIGAN NO. 13

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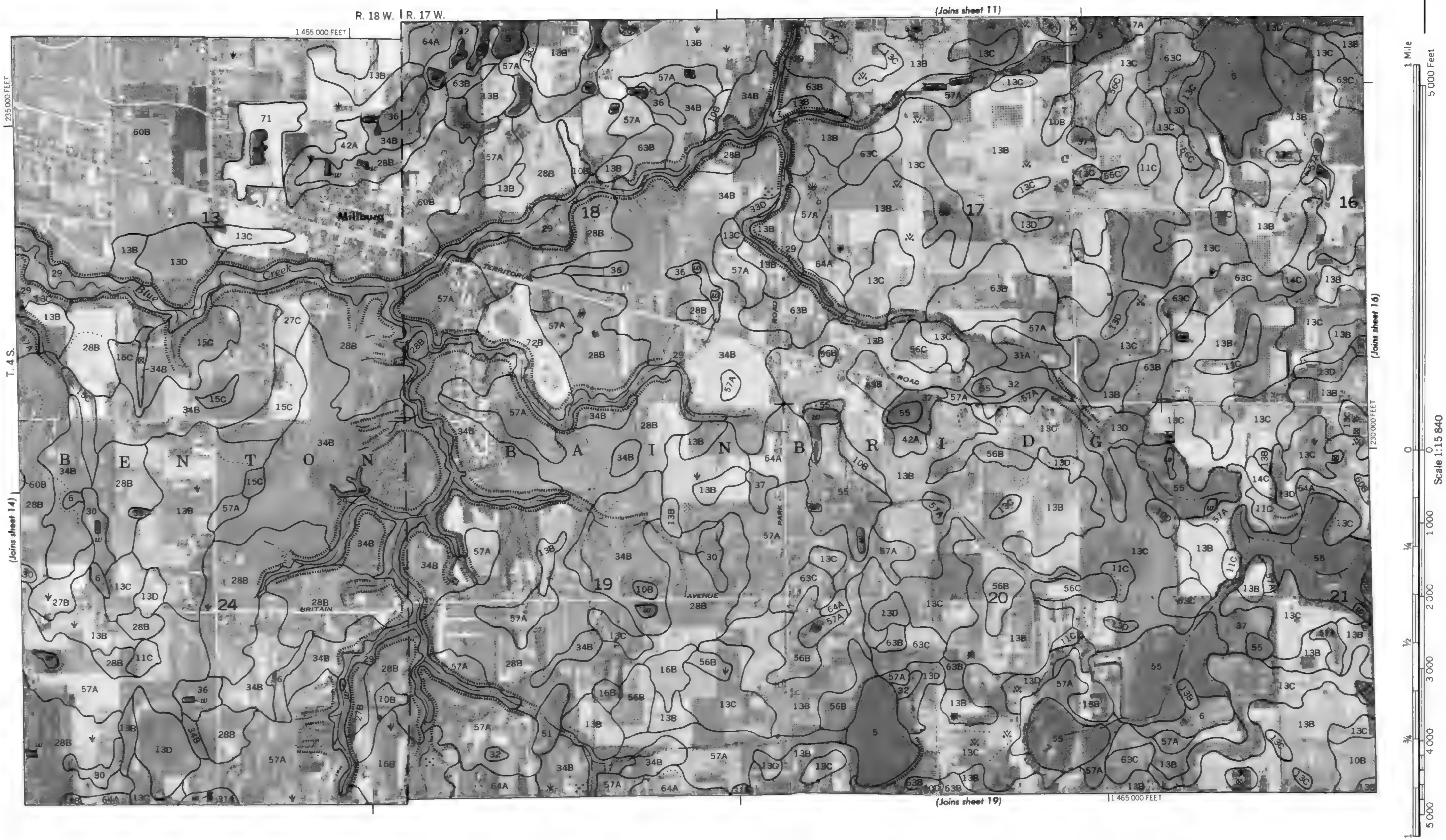
BERRIEN COUNTY, MICHIGAN NO. 14



BERRIEN COUNTY, MICHIGAN NO. 15

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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Coordinate grid ticks and land division corners, if shown, are approximately positioned

BERRIEN COUNTY, MICHIGAN NO. 17

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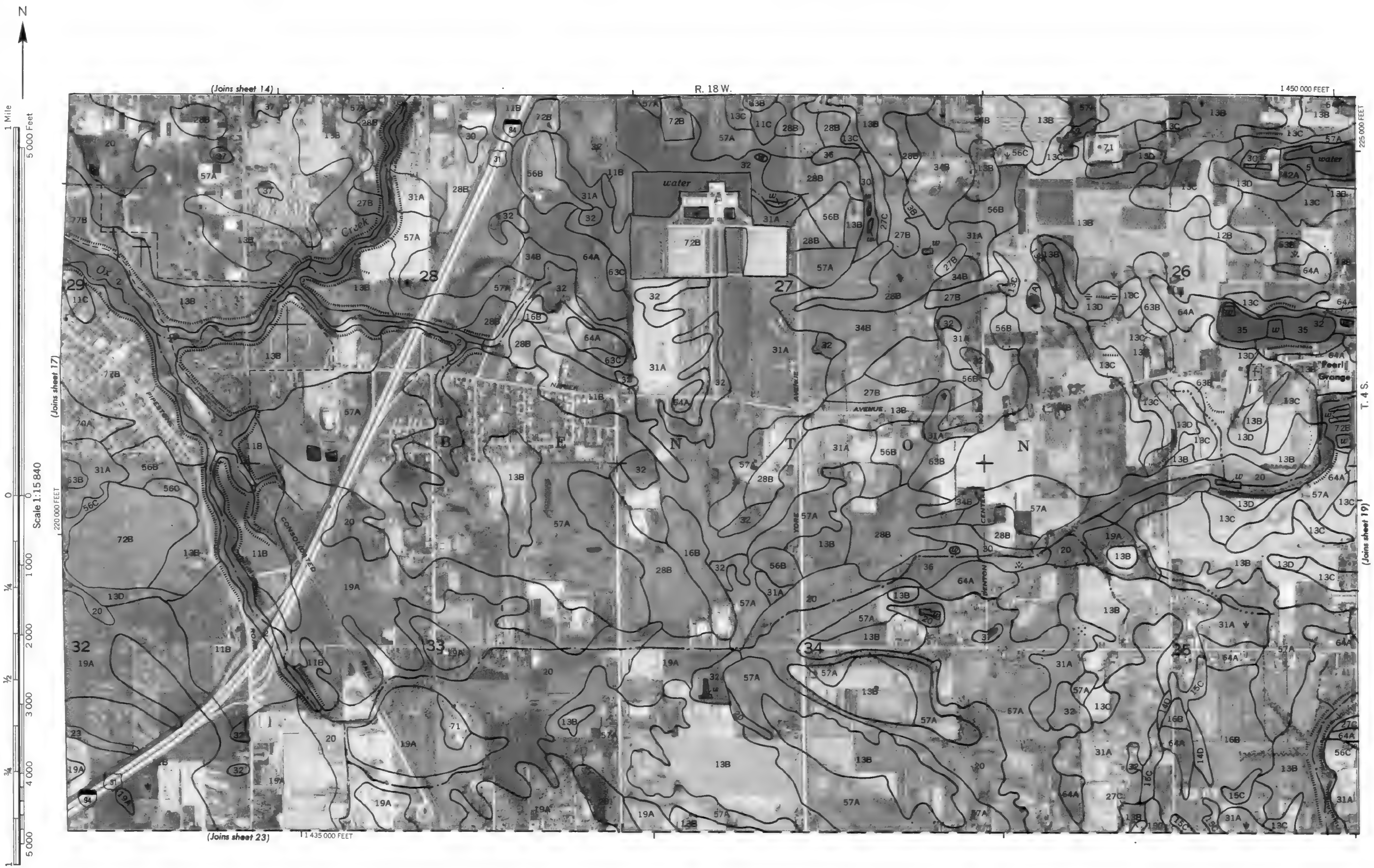

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

19

BERRIEN COUNTY, MICHIGAN NO. 19

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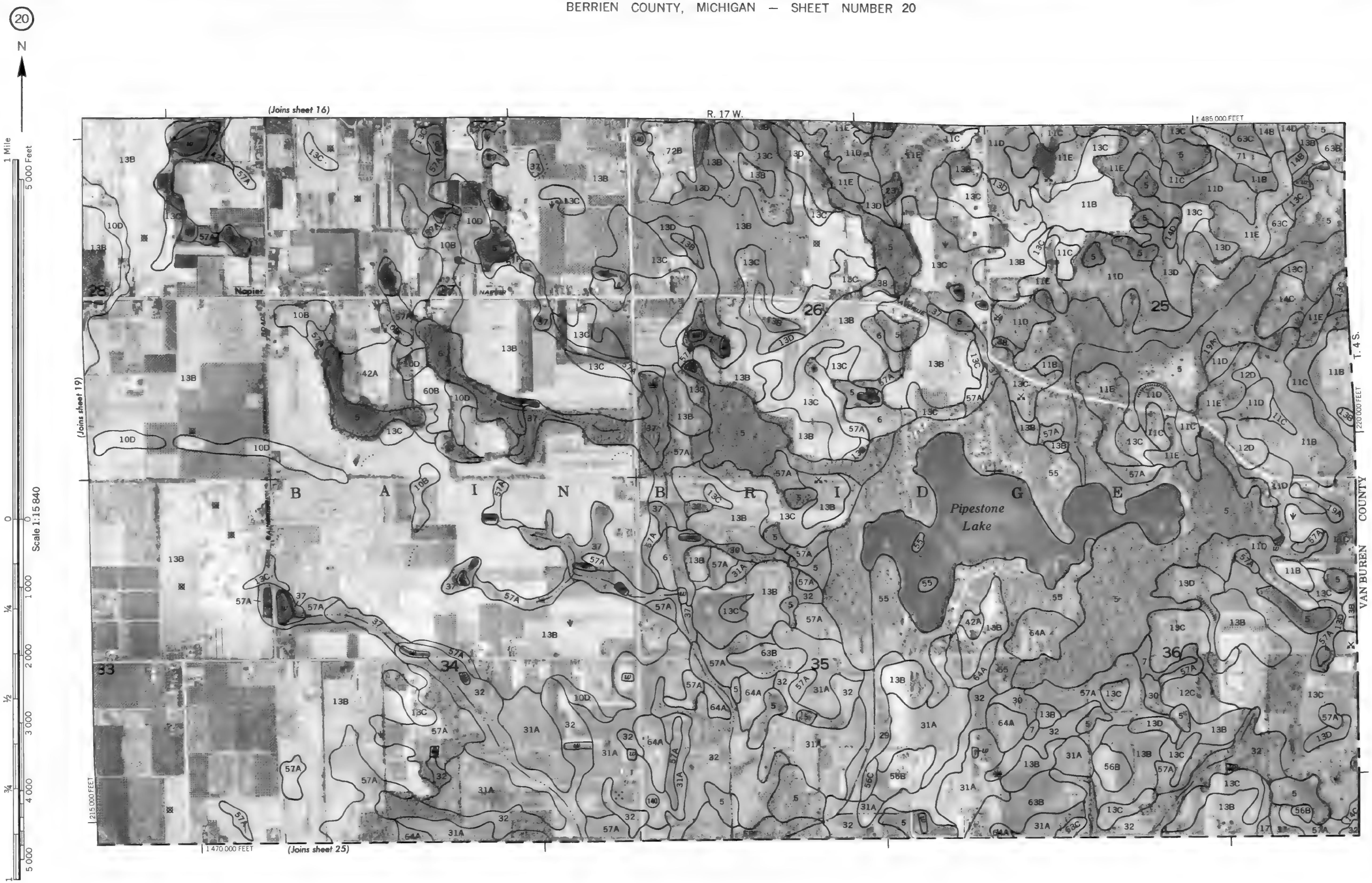

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned

BERRIEN COUNTY, MICHIGAN NO. 20

BERRIEN COUNTY, MICHIGAN NO. 21

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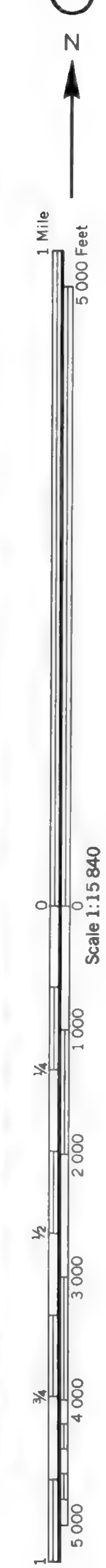
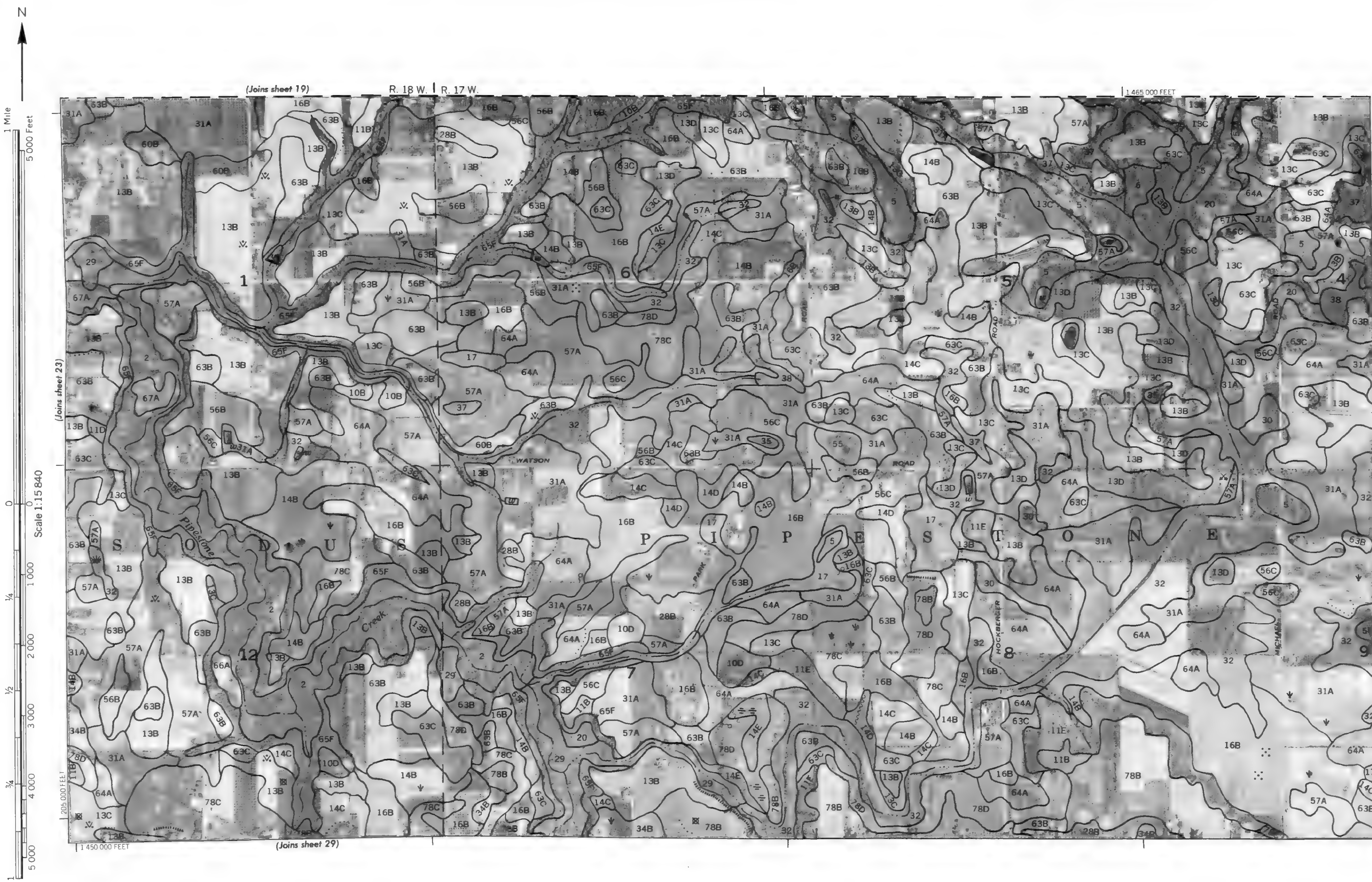


This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

BERRIEN COUNTY, MICHIGAN NO. 22

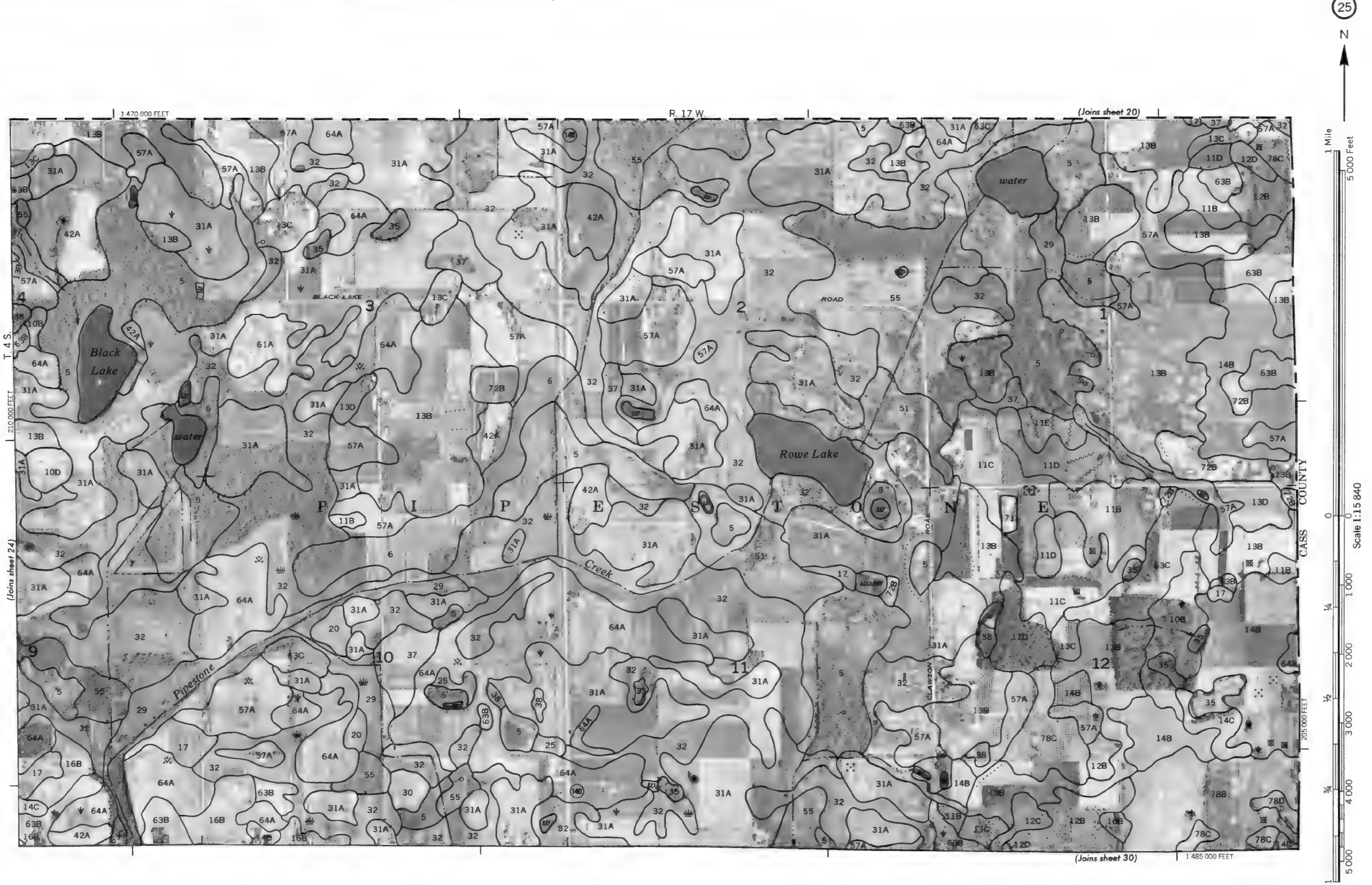
BERRIEN COUNTY, MICHIGAN NO. 23

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

BERRIEN COUNTY, MICHIGAN NO. 24



BERRIEN COUNTY, MICHIGAN, NO. 25

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.


26
N
1 Mile
5 000 Feet
Scale 1:15 840
(Joins sheet 21)
R. 19 W.
1 410 000 FEET
205 000 FEET
200 000 FEET
T. 5 S.
(Joins sheet 27)
1 395 000 FEET
(Joins sheet 31)
LAKE MICHIGAN
L I N C O L N
STEVENSVILLE
Grand Mere Lakes
Hickory
Creek
16
15
17
20
21
22
This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.
BERRIEN COUNTY, MICHIGAN NO. 26

BERRIEN COUNTY, MICHIGAN NO. 27

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BERRIEN COUNTY, MICHIGAN NO. 28

BERRIEN COUNTY, MICHIGAN NO. 29

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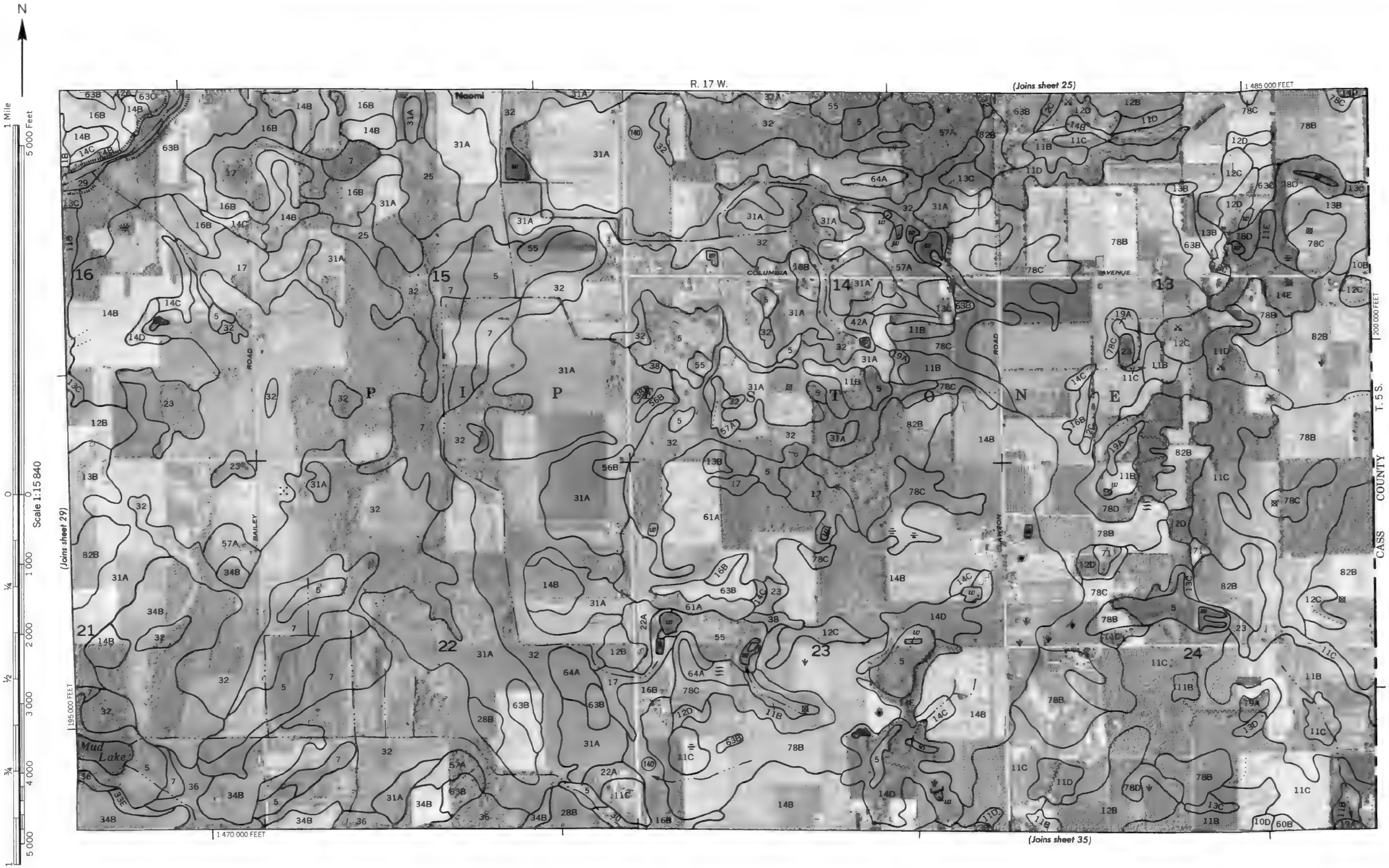

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

BERRIEN COUNTY, MICHIGAN NO. 31

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

BERRIEN COUNTY, MICHIGAN — SHEET NUMBER 32

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

33

N

1 Mile
5 000 Feet
0
1 000
¼
2 000
½
3 000
¾
4 000
5 000
Scale 1:15 840

BERRIEN COUNTY, MICHIGAN NO. 33

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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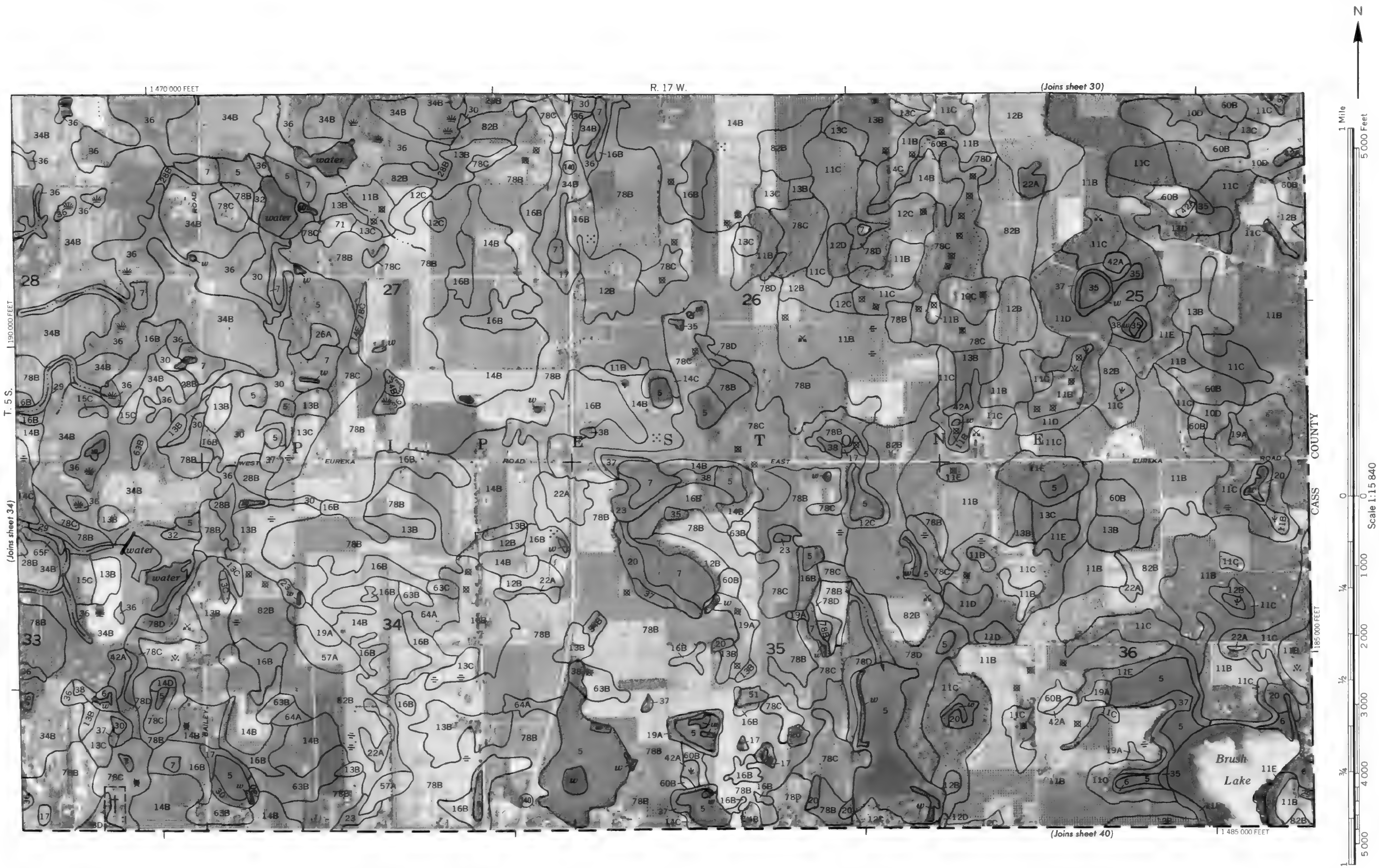
BERRIEN COUNTY, MICHIGAN NO. 34



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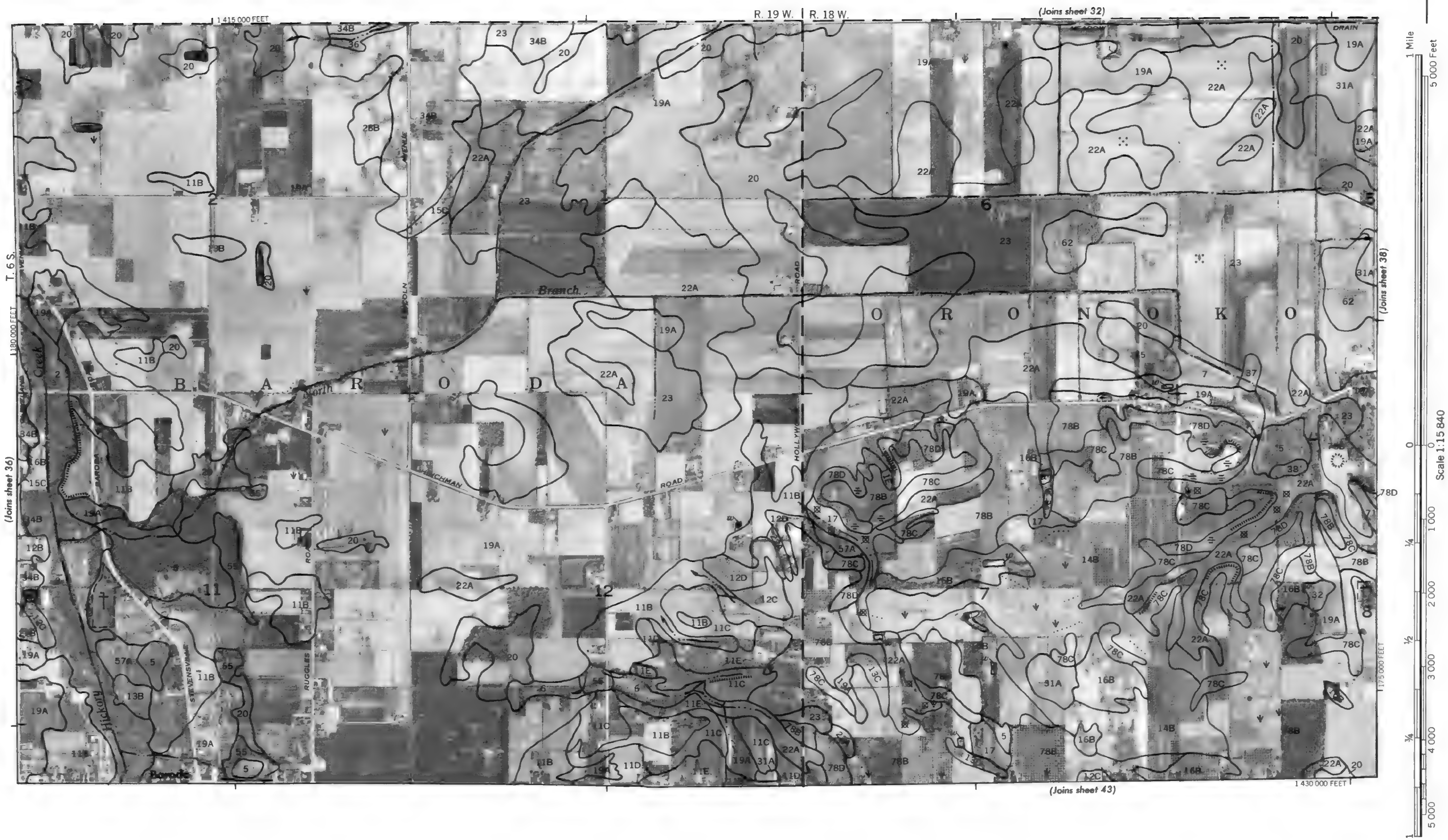
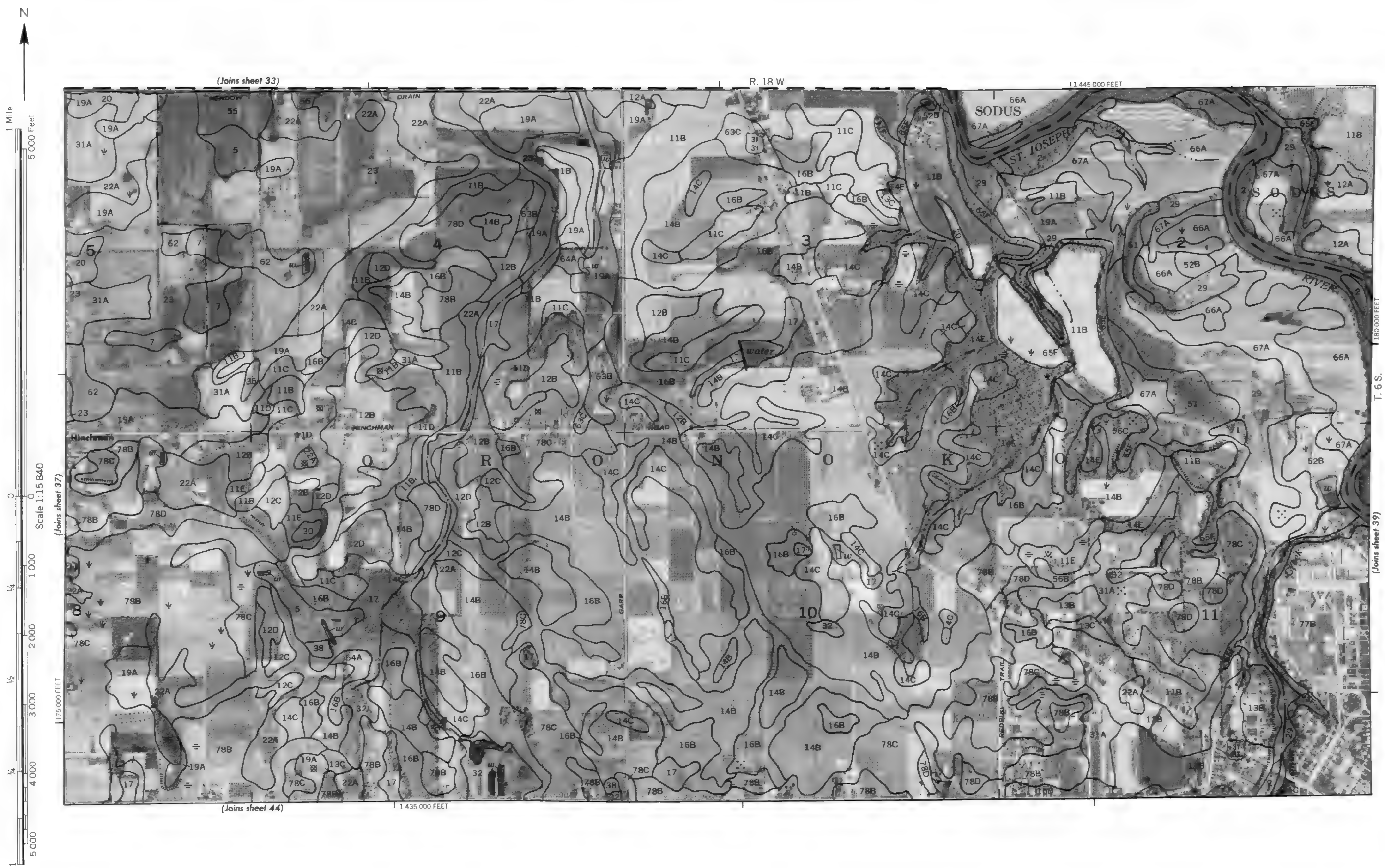


BERRIEN COUNTY, MICHIGAN NO. 37
This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



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BERRIEN COUNTY, MICHIGAN NO. 38

BERRIEN COUNTY, MICHIGAN NO. 39

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BERRIEN COUNTY, MICHIGAN — SHEET NUMBER 40

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BERRIEN COUNTY, MICHIGAN NO. 40

41

BERRIEN COUNTY, MICHIGAN NO. 41

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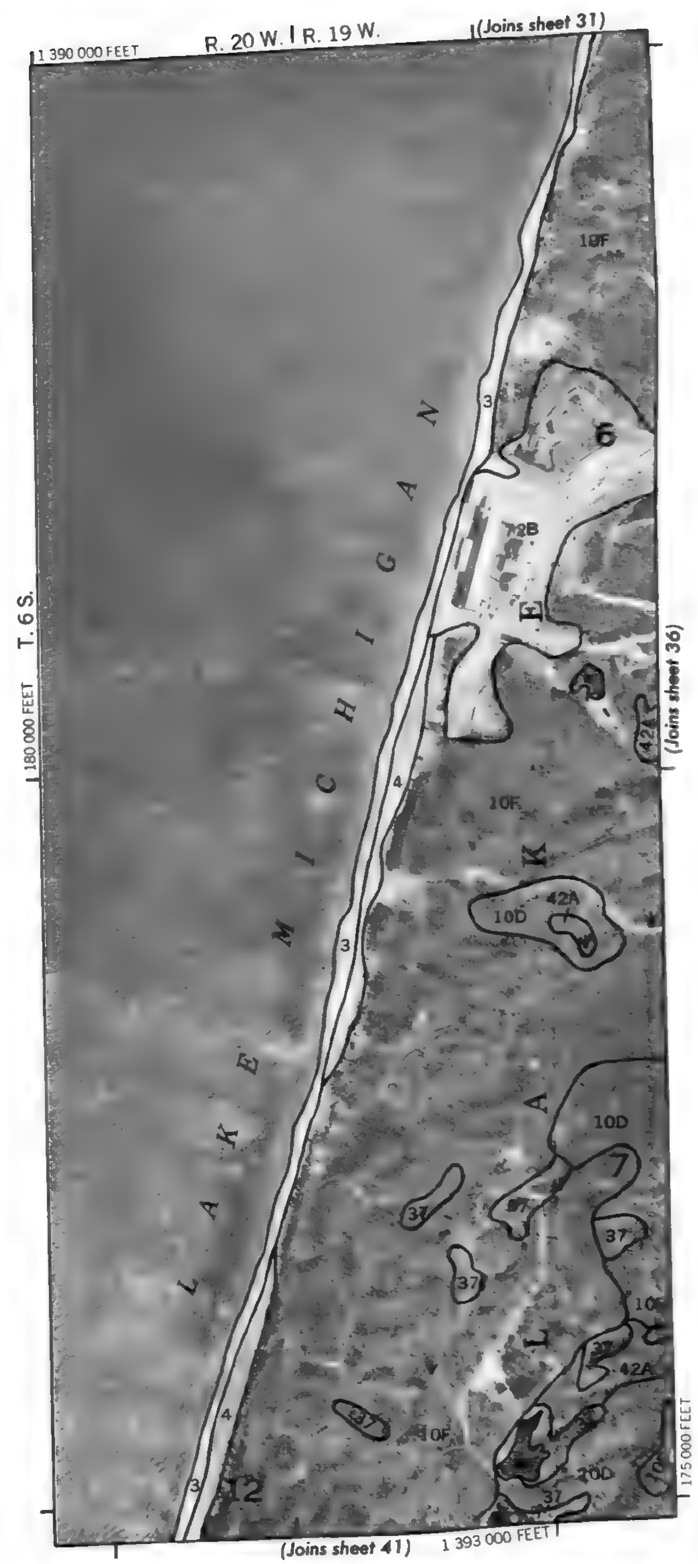
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

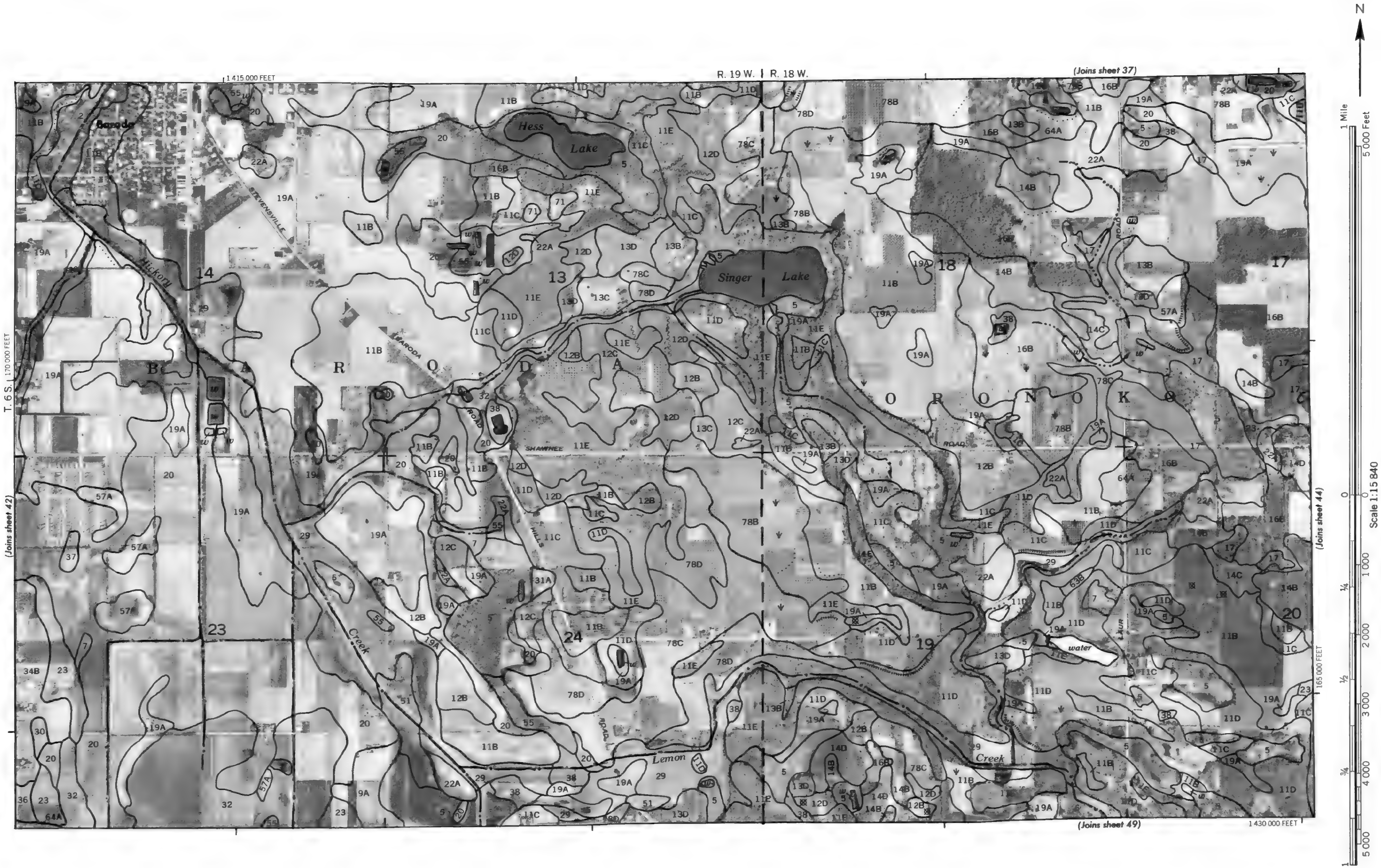
INSET A

INSET B



This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

BERRIEN COUNTY, MICHIGAN NO. 42



BERRIEN COUNTY, MICHIGAN NO. 43

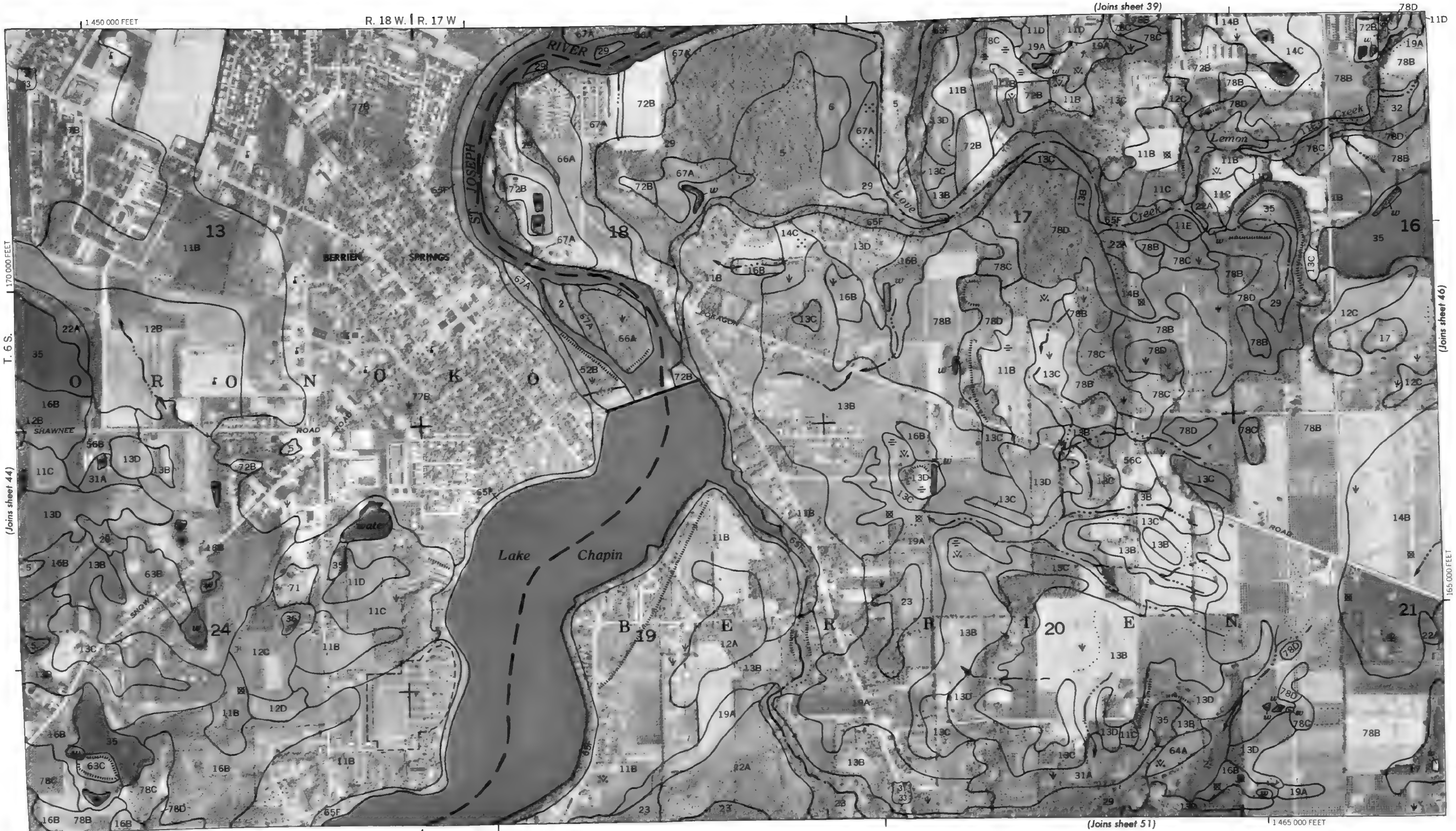
This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

BERRIEN COUNTY, MICHIGAN — SHEET NUMBER 44

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

BERRIEN COUNTY, MICHIGAN NO. 44

N



1 Mile
5 000 Feet
0
1/4
1/2
3/4
1 000
2 000
3 000
4 000
5 000
Scale 1:15 840

BERRIEN COUNTY, MICHIGAN NO. 45

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BERRIEN COUNTY, MICHIGAN NO. 46


(Joins sheet 41)
R. 20 W. | R. 19 W.
1 380 000 FEET
160 000 FEET
T. 6 S.
LAKE MICHIGAN
Great Warren Dune
Mt. Randall
Pikes Peak
Tower Hill
Mt. Fuller
LAKE
(Joins sheet 48)
155 000 FEET
(Joins sheet 53)
1 390 000 FEET
N
Scale 1:15 840
1 Mile
5 000 Feet

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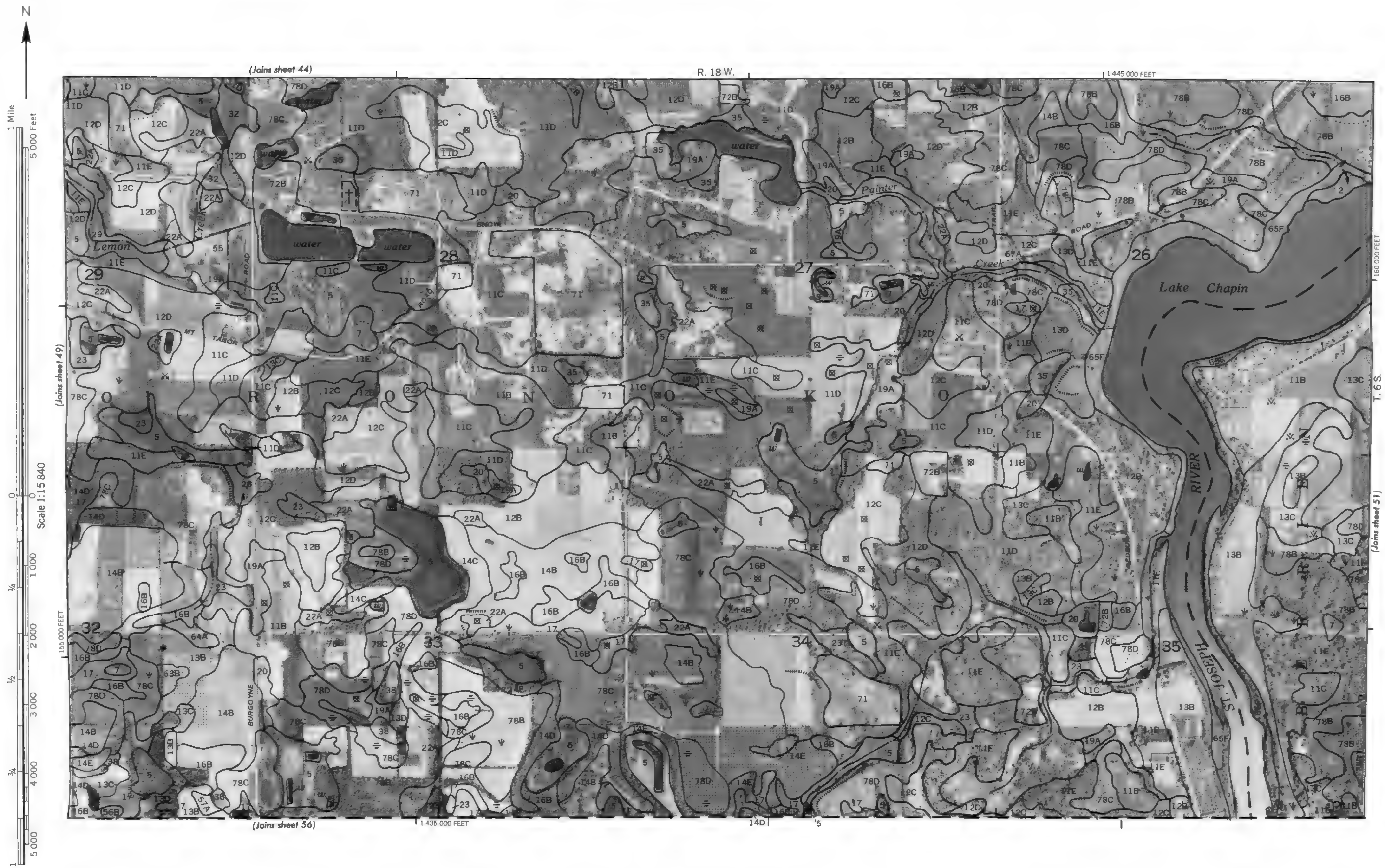
Coordinate grid ticks and land division corners, if shown, are approximately positioned

BERRIEN COUNTY, MICHIGAN NO. 48

BERRIEN COUNTY, MICHIGAN NO. 49

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies
Coordinate grid ticks and land division corners, if shown, are approximately positioned



This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

51

N

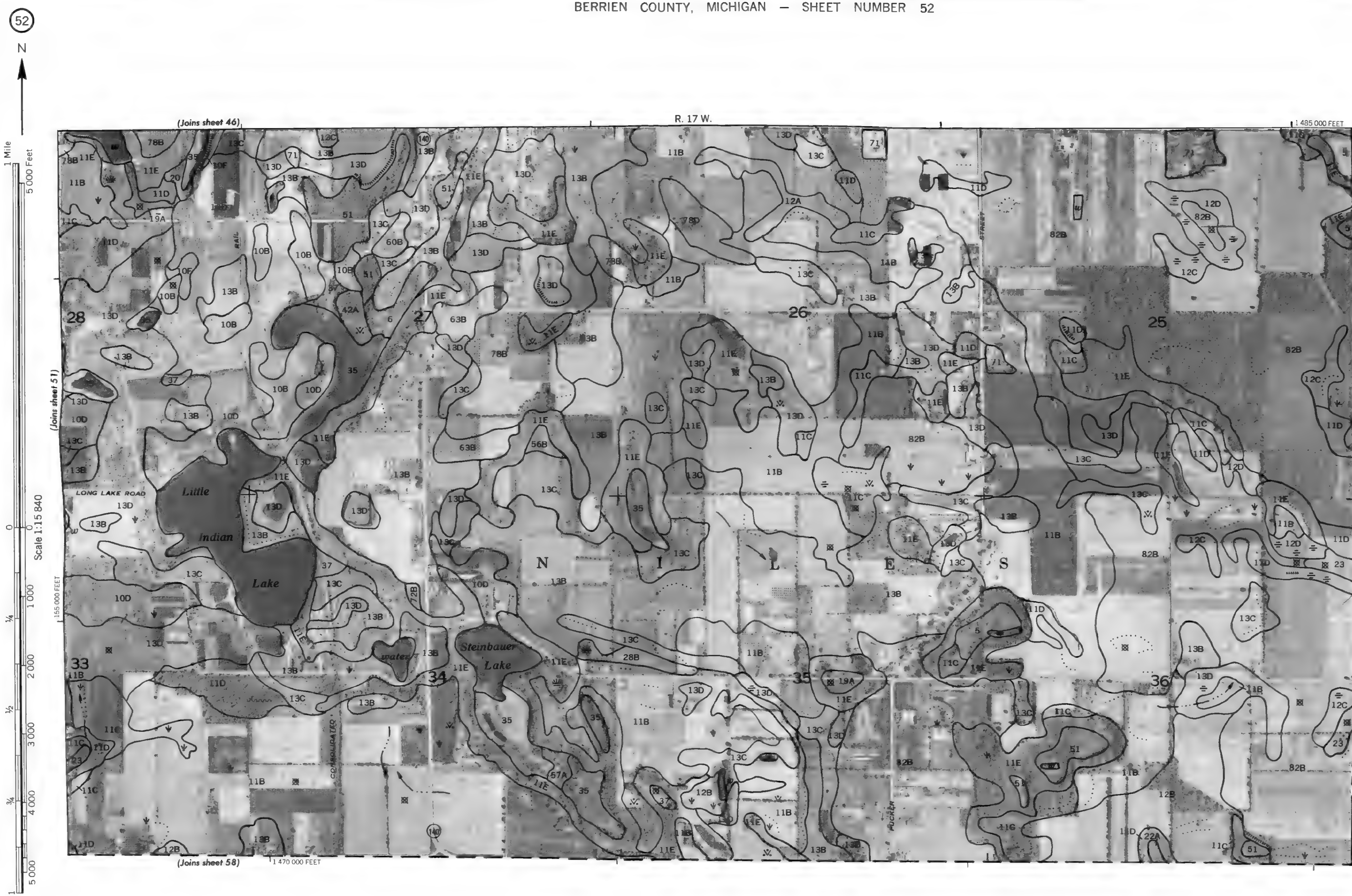
Scale 1:15 840

1 Mile — 1/2 — 0

5 000 Feet — 4 000 — 3 000 — 2 000 — 1 000 — 0 — 5 000

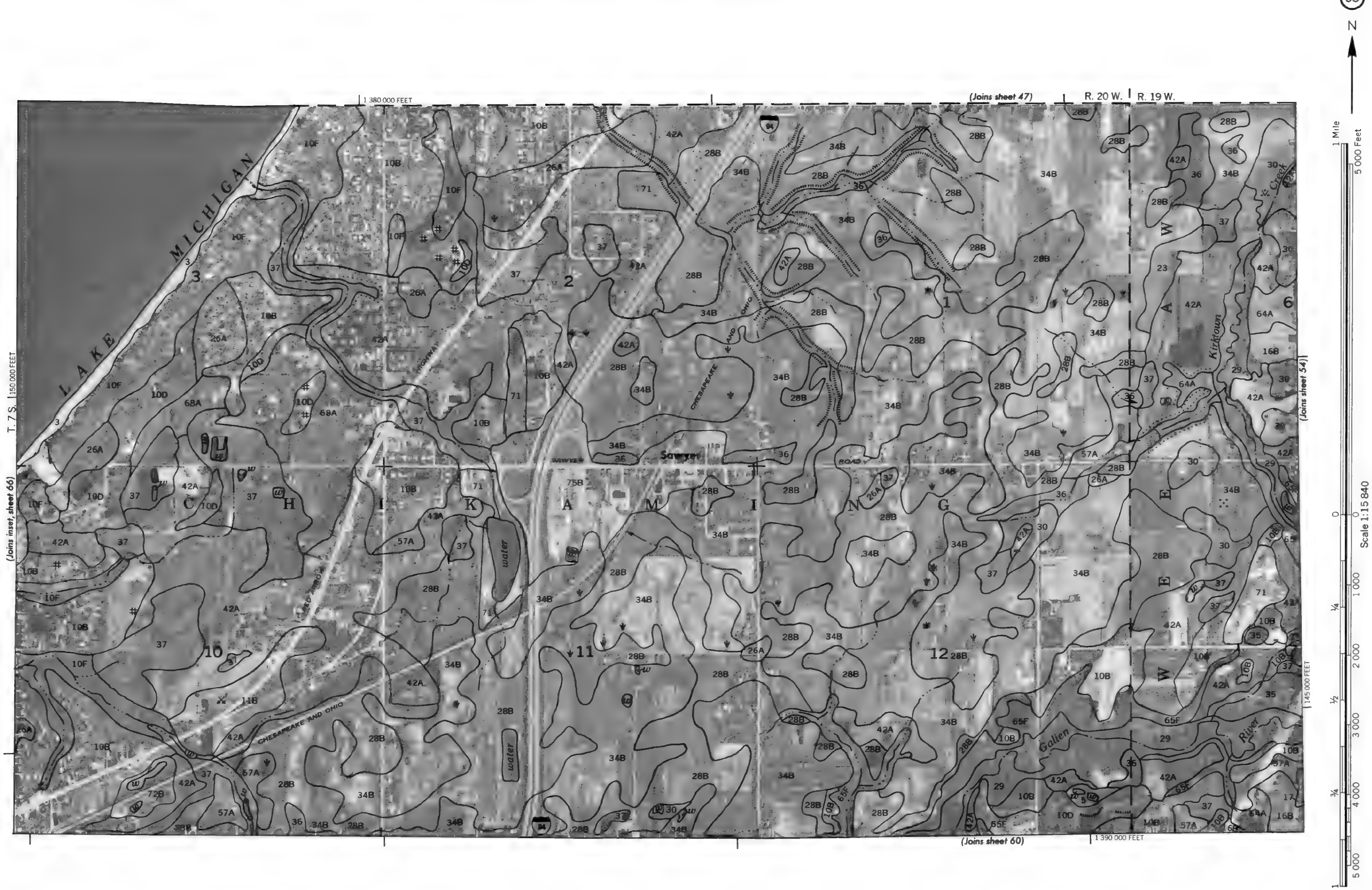
BERRIEN COUNTY, MICHIGAN NO. 51

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

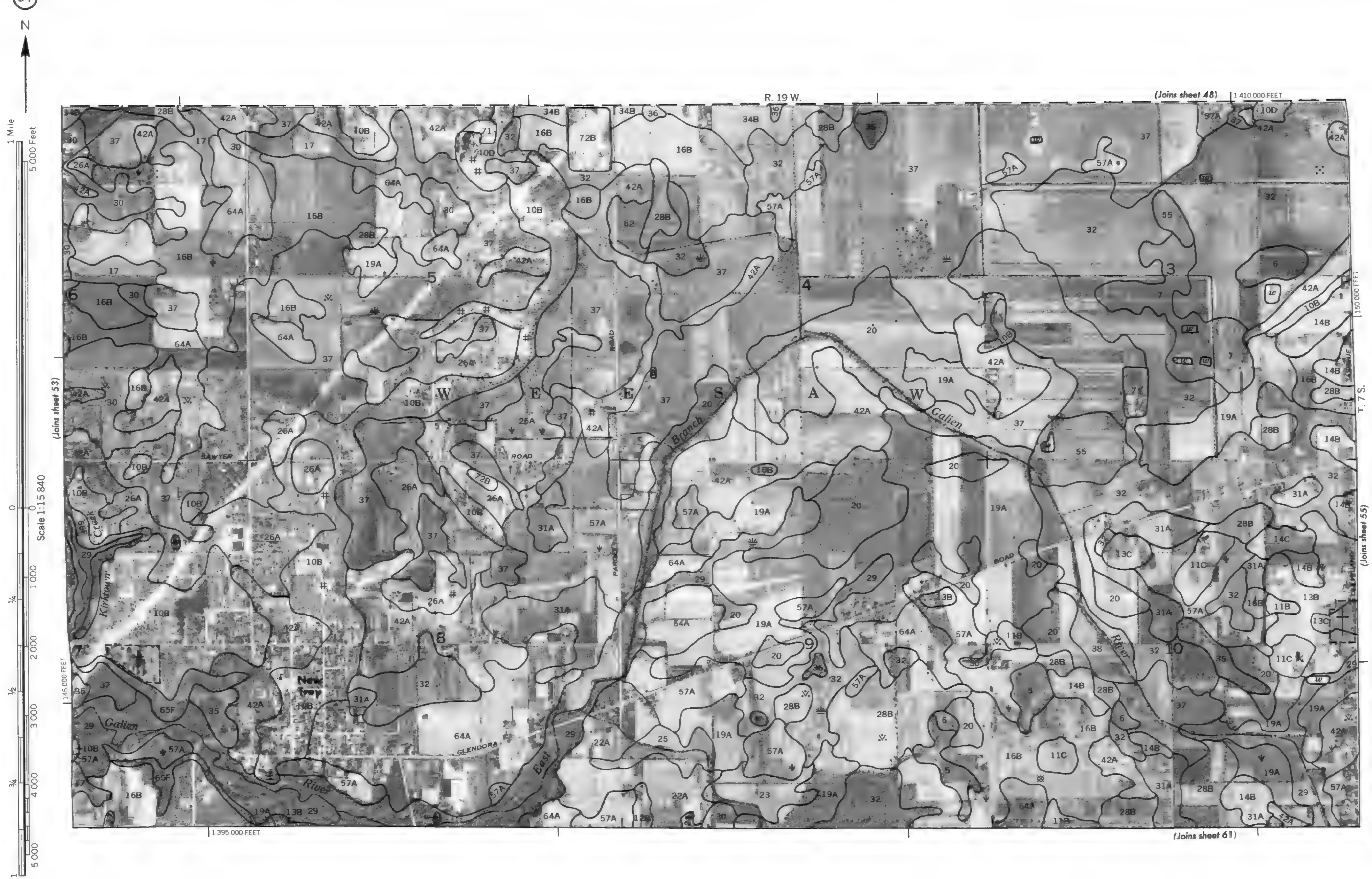


This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

BERRIEN COUNTY, MICHIGAN NO. 52



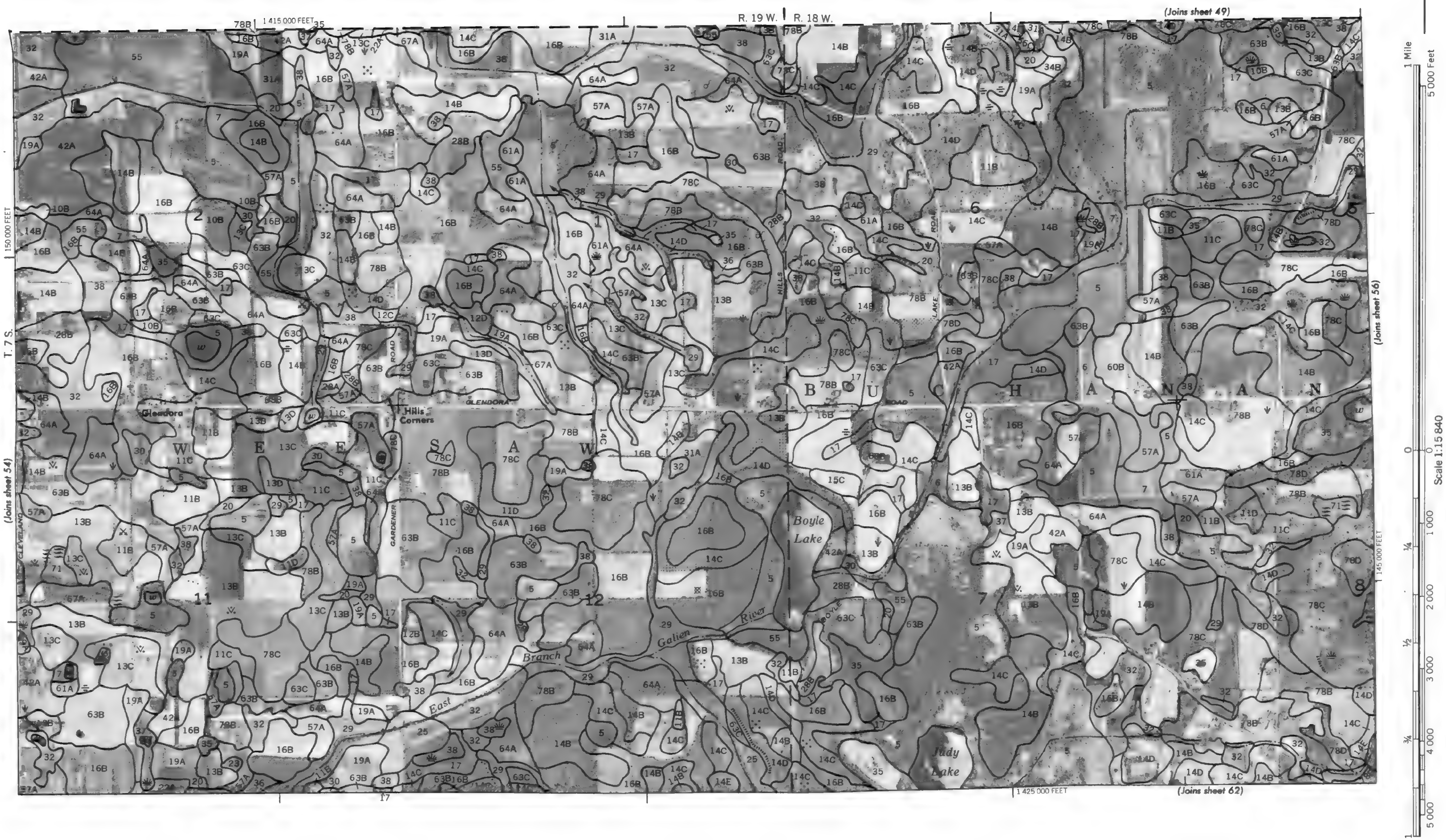
This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

BERRIEN COUNTY, MICHIGAN NO. 54

55



BERRIEN COUNTY, MICHIGAN NO. 55
This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

BERRIEN COUNTY, MICHIGAN — SHEET NUMBER 56

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies
Coordinate grid ticks and land division corners, if shown, are approximately positioned

BERRIEN COUNTY, MICHIGAN NO. 56

BERRIEN COUNTY, MICHIGAN NO. 57

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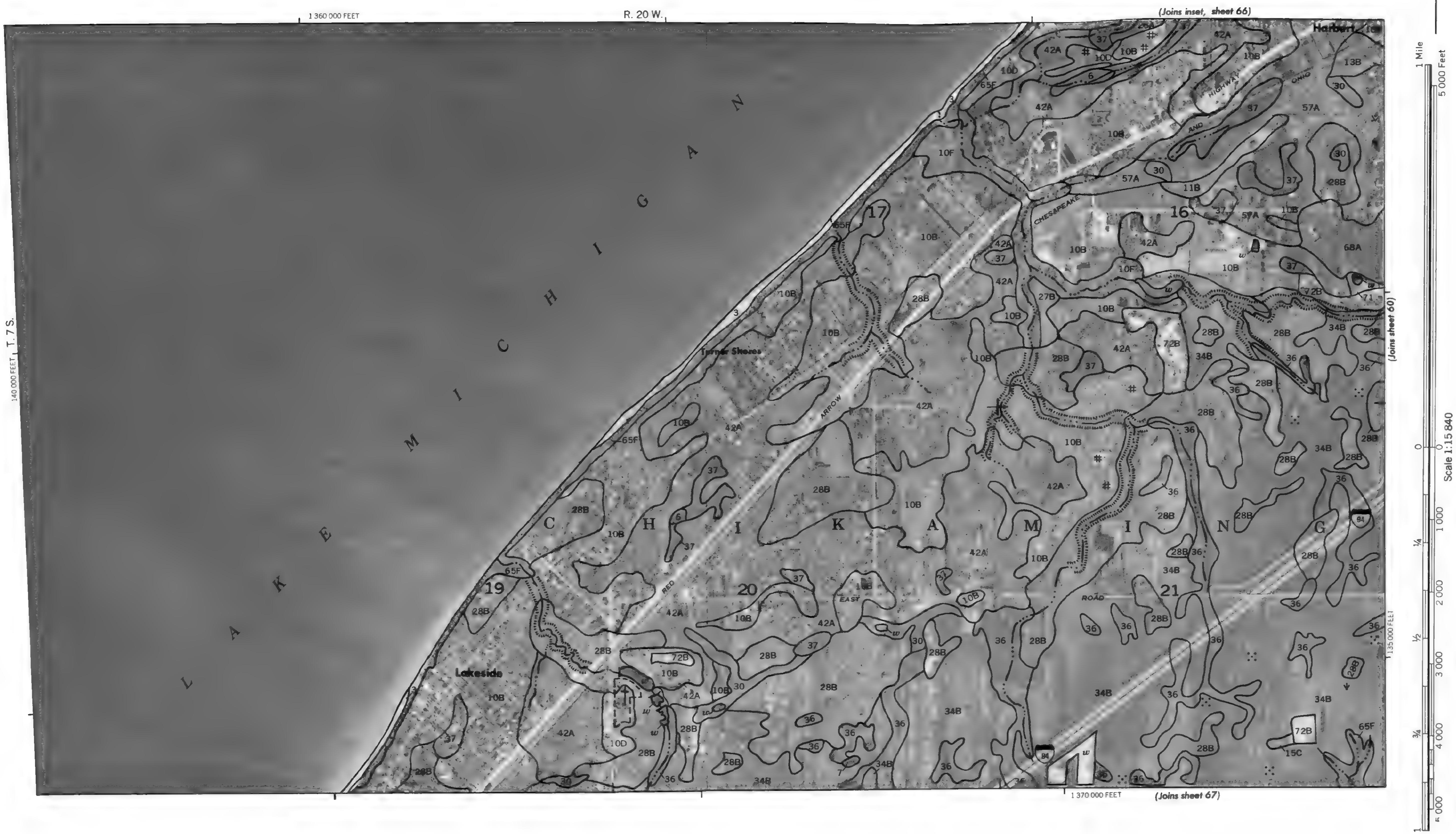
BERRIEN COUNTY, MICHIGAN NO. 58

59

N



BERRIEN COUNTY, MICHIGAN NO. 59

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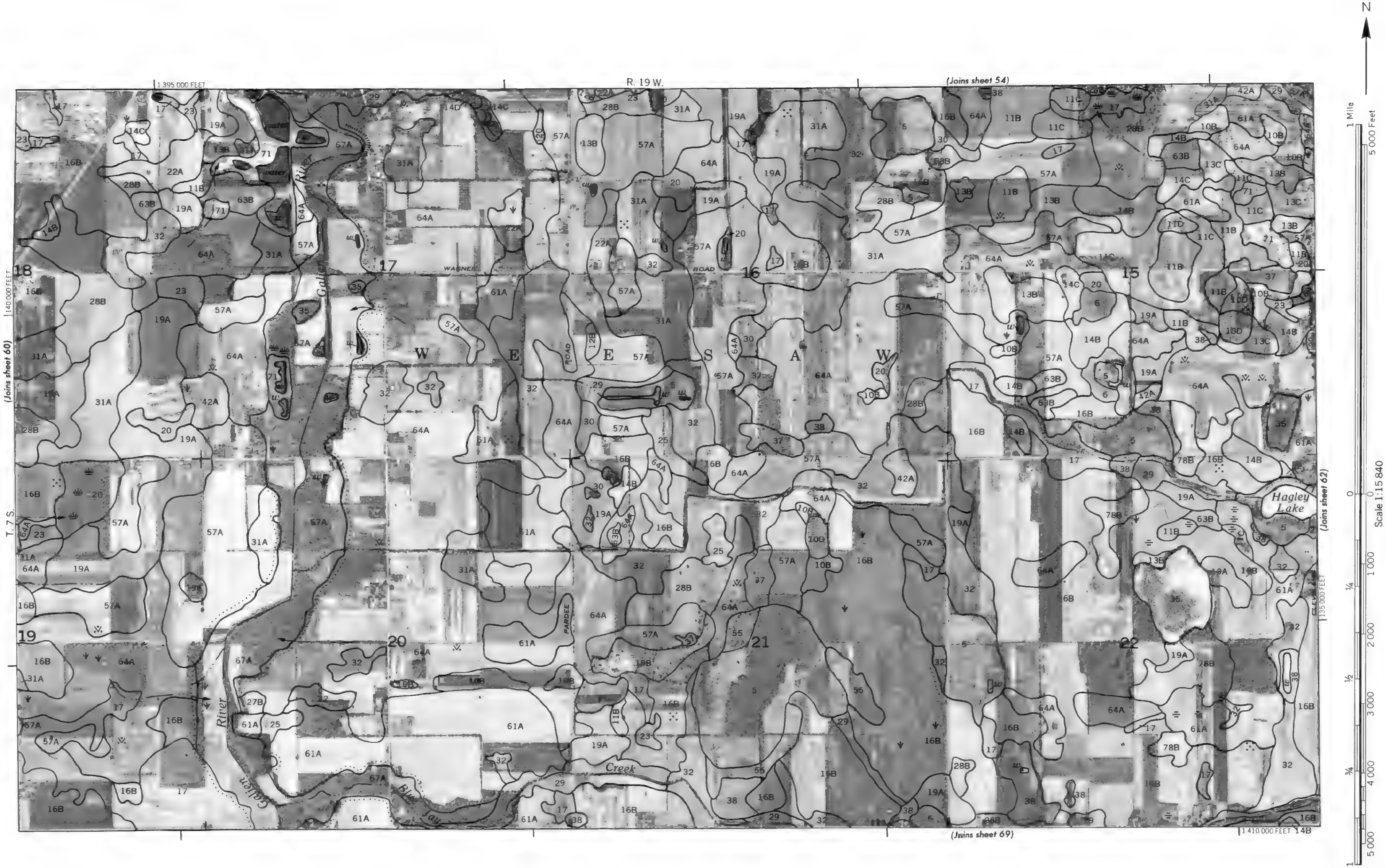
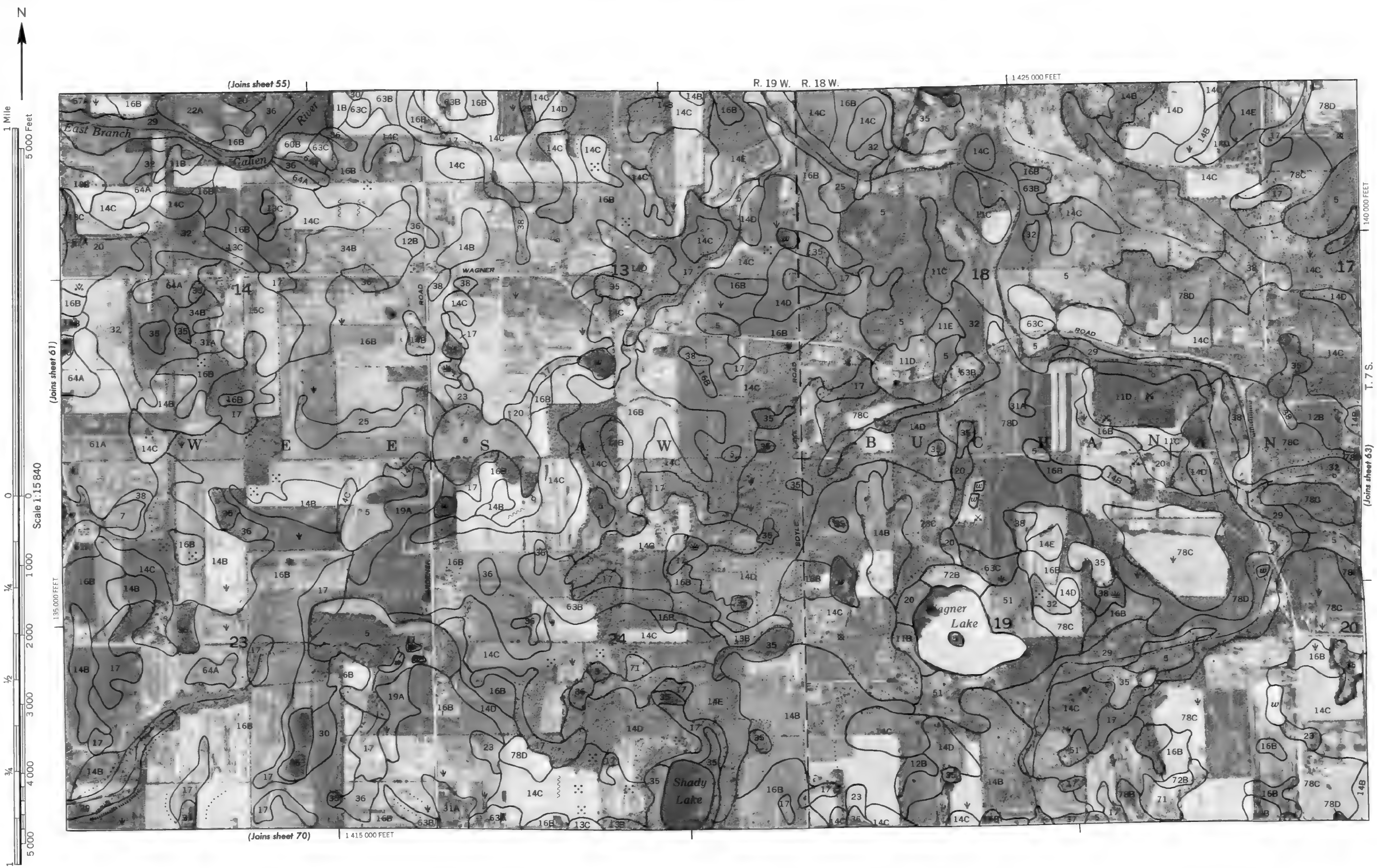
BERRIEN COUNTY, MICHIGAN NO. 60

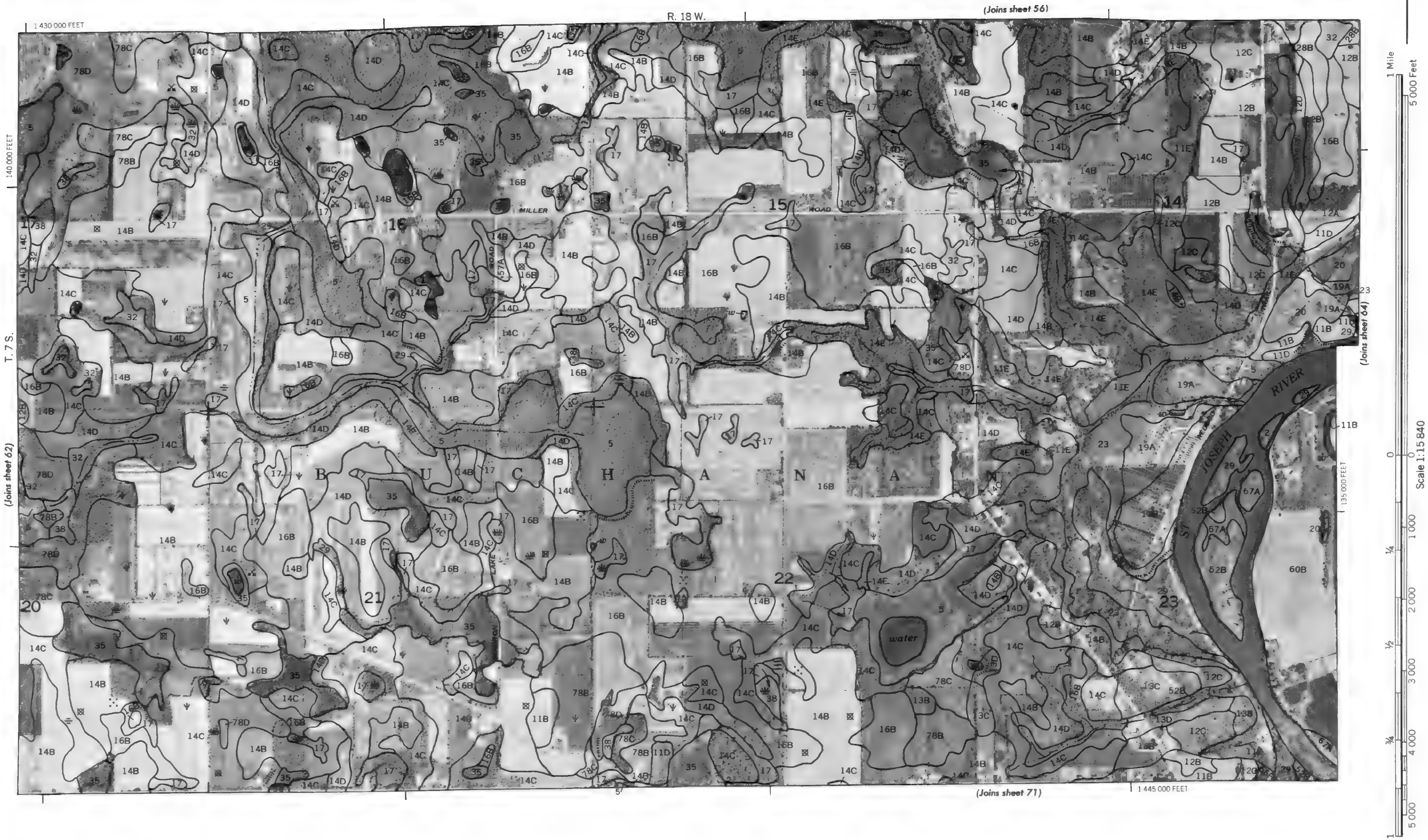
BERRIEN COUNTY, MICHIGAN NO. 61

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.





This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



BERRIEN COUNTY, MICHIGAN NO. 63

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

65
N
1 Mile
5 000 Feet
Scale 1:15 840

BERRIEN COUNTY, MICHIGAN NO. 65
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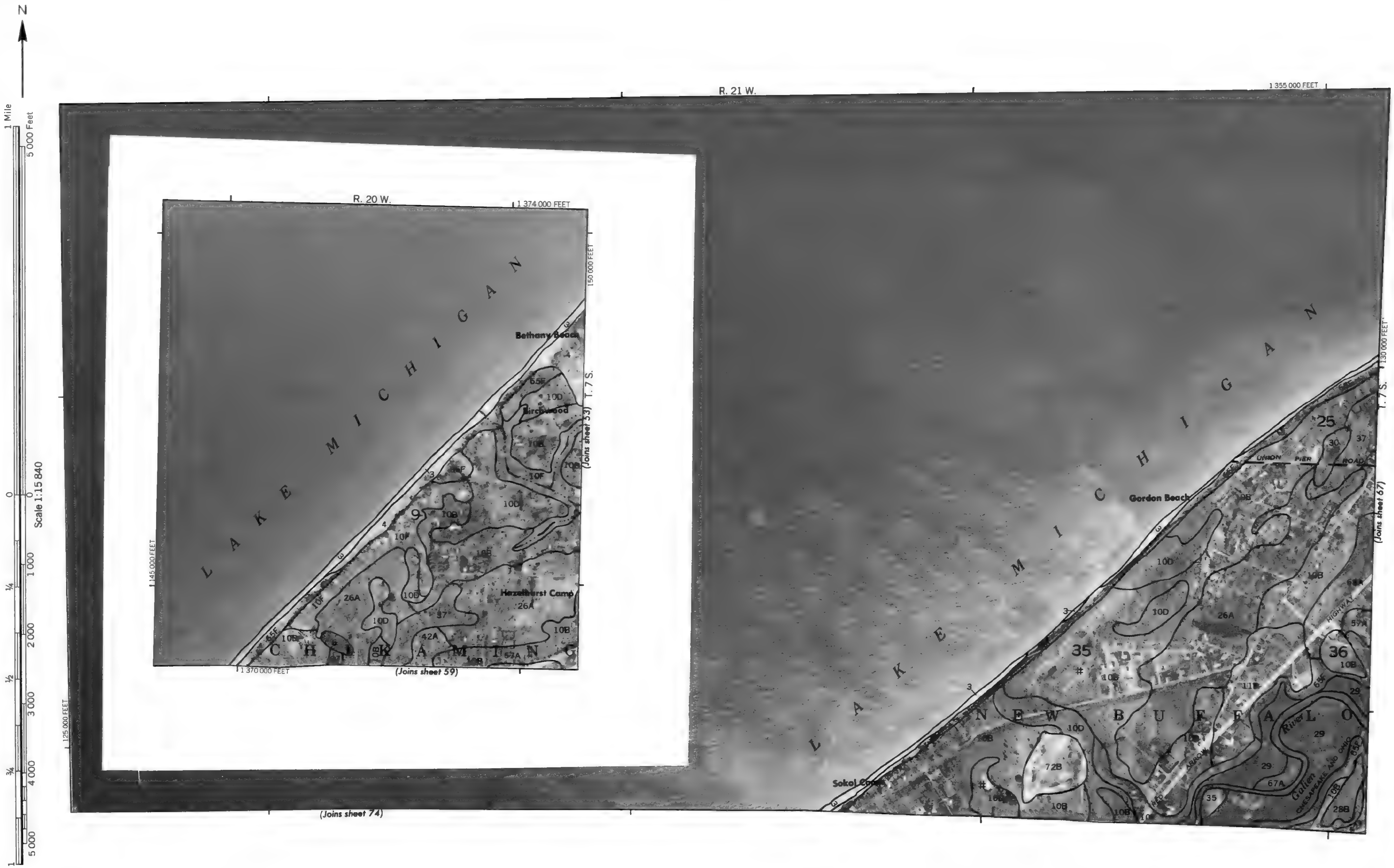

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

(67)

N

Scale 1:15 840

1 Mile

5 000 Feet

0 ¼ ½ ¾ 1

0 1 000 2 000 3 000 4 000 5 000

BERRIEN COUNTY, MICHIGAN NO. 67

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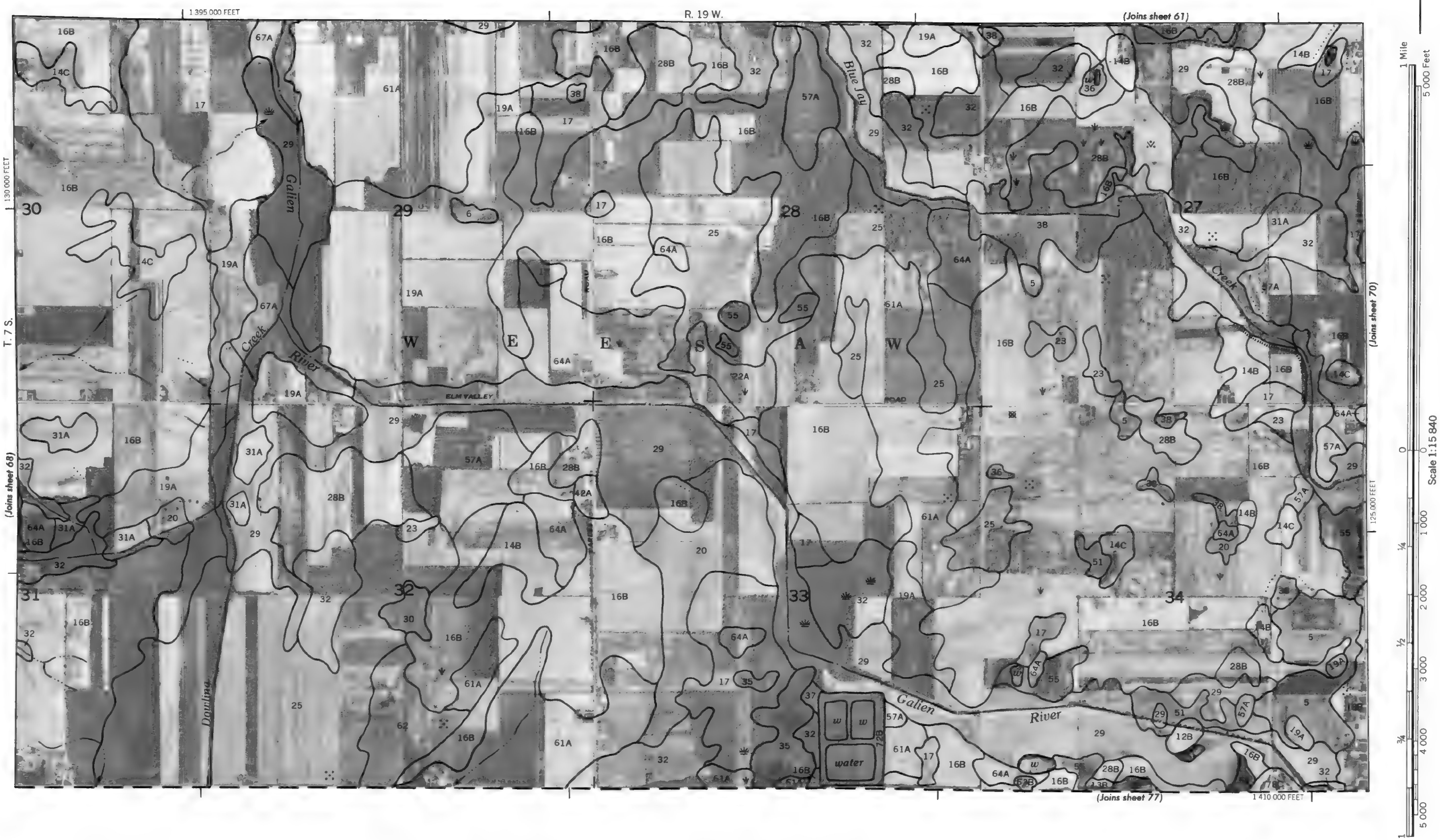
BERRIEN COUNTY, MICHIGAN NO. 68

69

N



BERRIEN COUNTY, MICHIGAN NO. 69

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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BERRIEN COUNTY, MICHIGAN NO. 71

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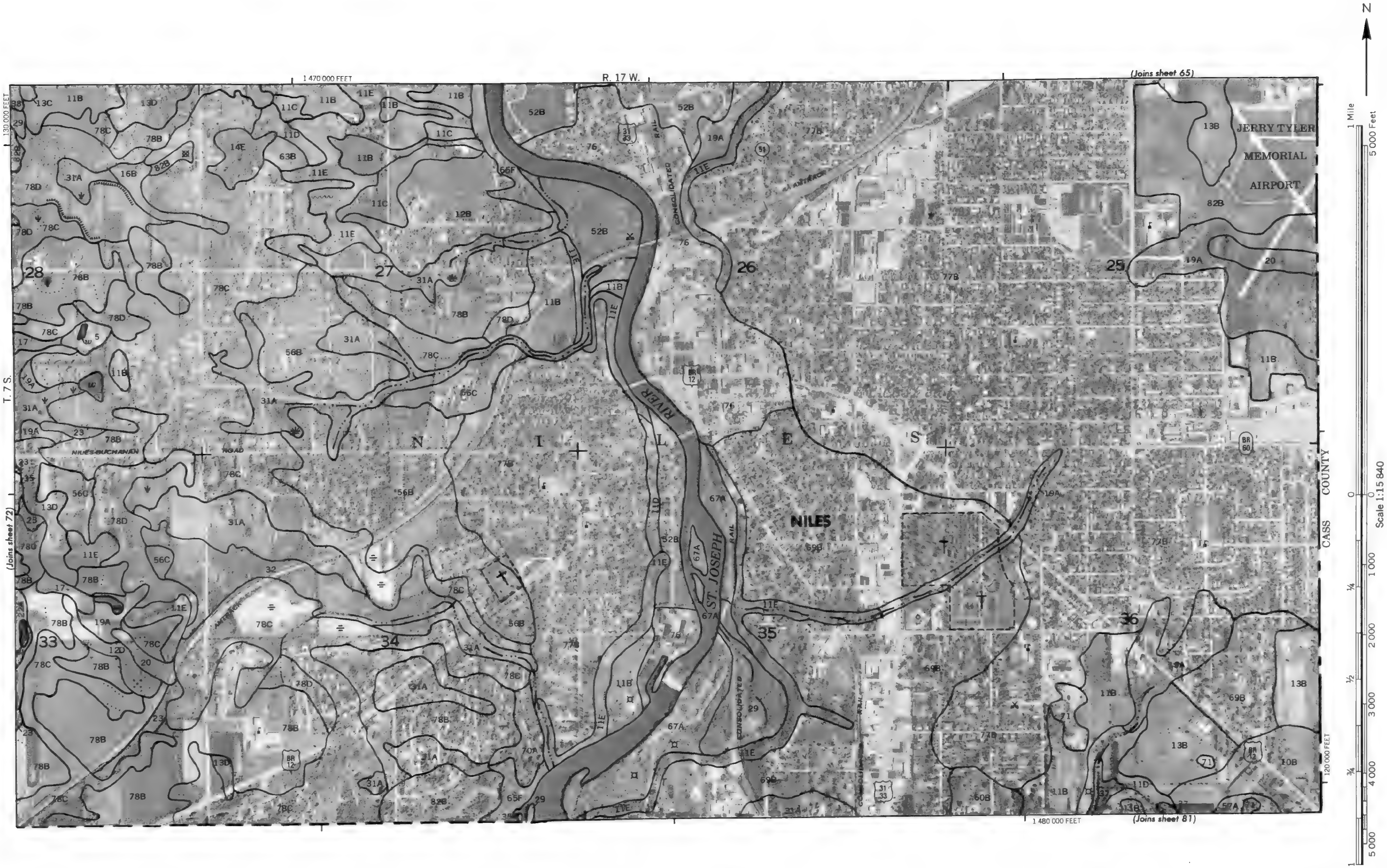
72

N

1 Mile
5 000 Feet
0
1 000
2 000
3 000
4 000
5 000
0
1/4
1/2
3/4
1
Scale 1:15 840

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

BERRIEN COUNTY, MICHIGAN NO. 72



BERRIEN COUNTY, MICHIGAN NO. 73

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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BERRIEN COUNTY, MICHIGAN NO. 75

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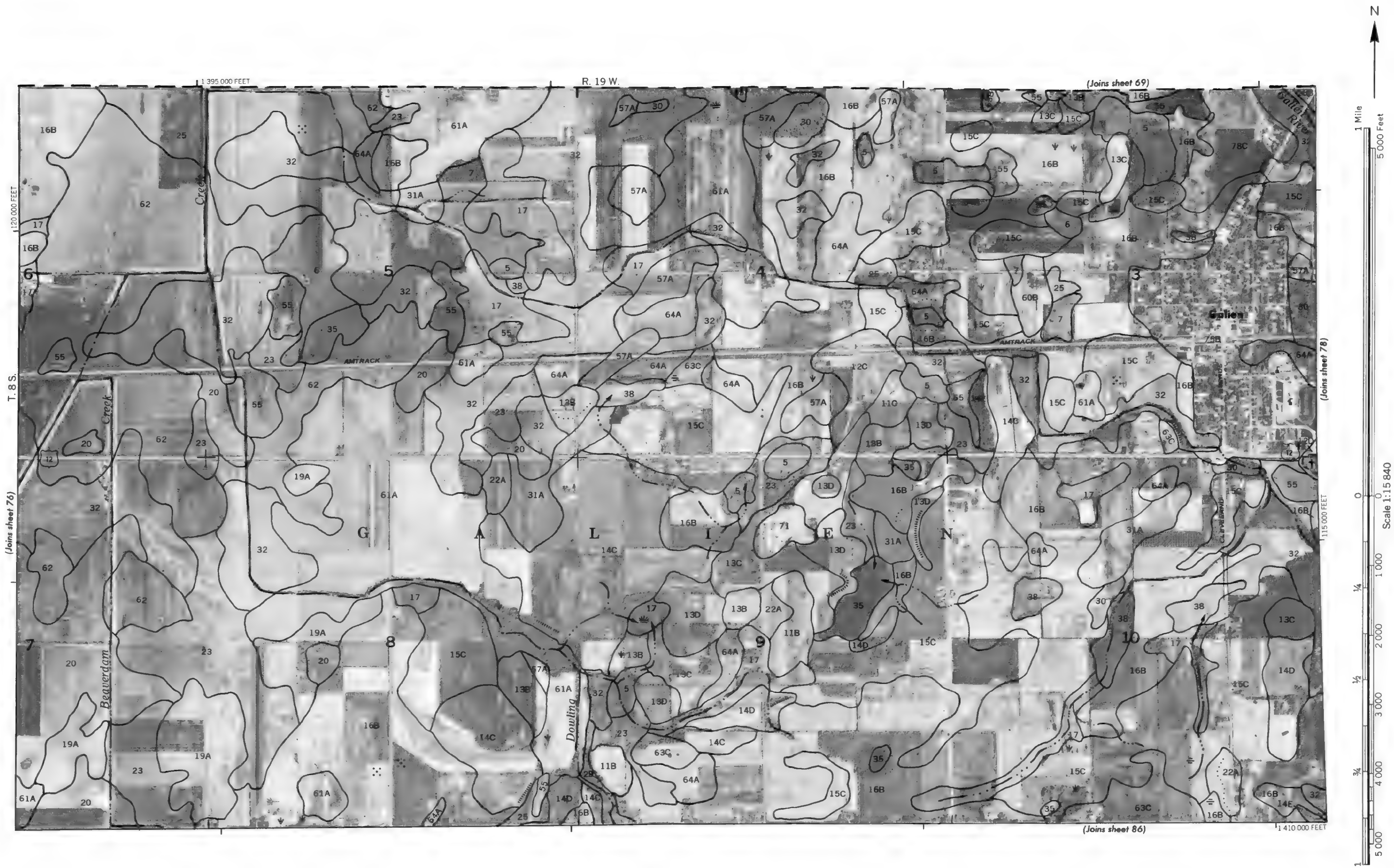

BERRIEN COUNTY, MICHIGAN NO. 77

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

BERRIEN COUNTY, MICHIGAN — SHEET NUMBER 78

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

BERRIEN COUNTY, MICHIGAN NO. 78

BERRIEN COUNTY, MICHIGAN NO. 79

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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BERRIEN COUNTY, MICHIGAN NO. 80

81

BERRIEN COUNTY, MICHIGAN NO. 81

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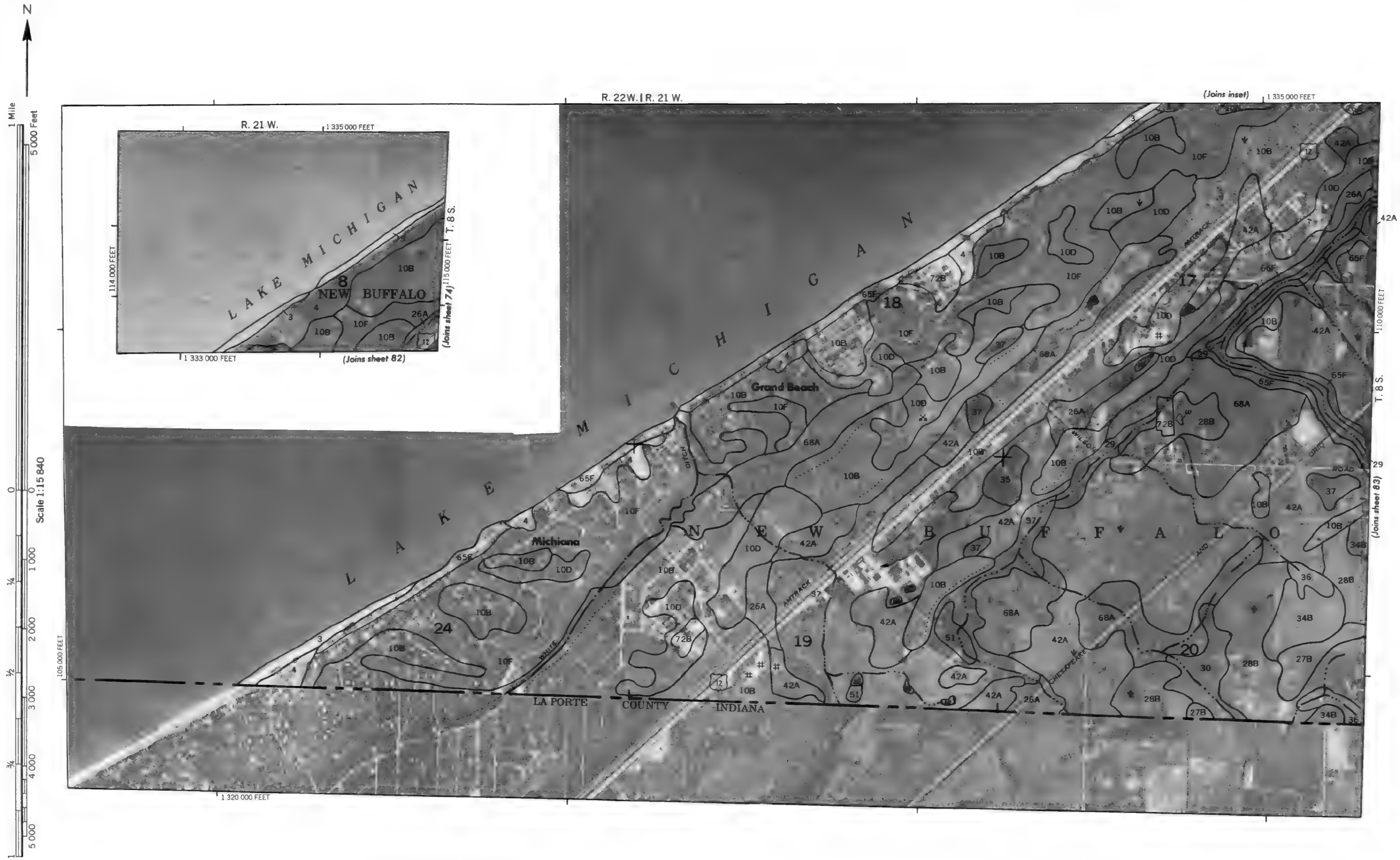

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

BERRIEN COUNTY, MICHIGAN NO. 82

BERRIEN COUNTY, MICHIGAN NO. 83

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Coordinate grid ticks and land division corners, if shown, are approximately positioned.

BERRIEN COUNTY, MICHIGAN, NO. 85

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies
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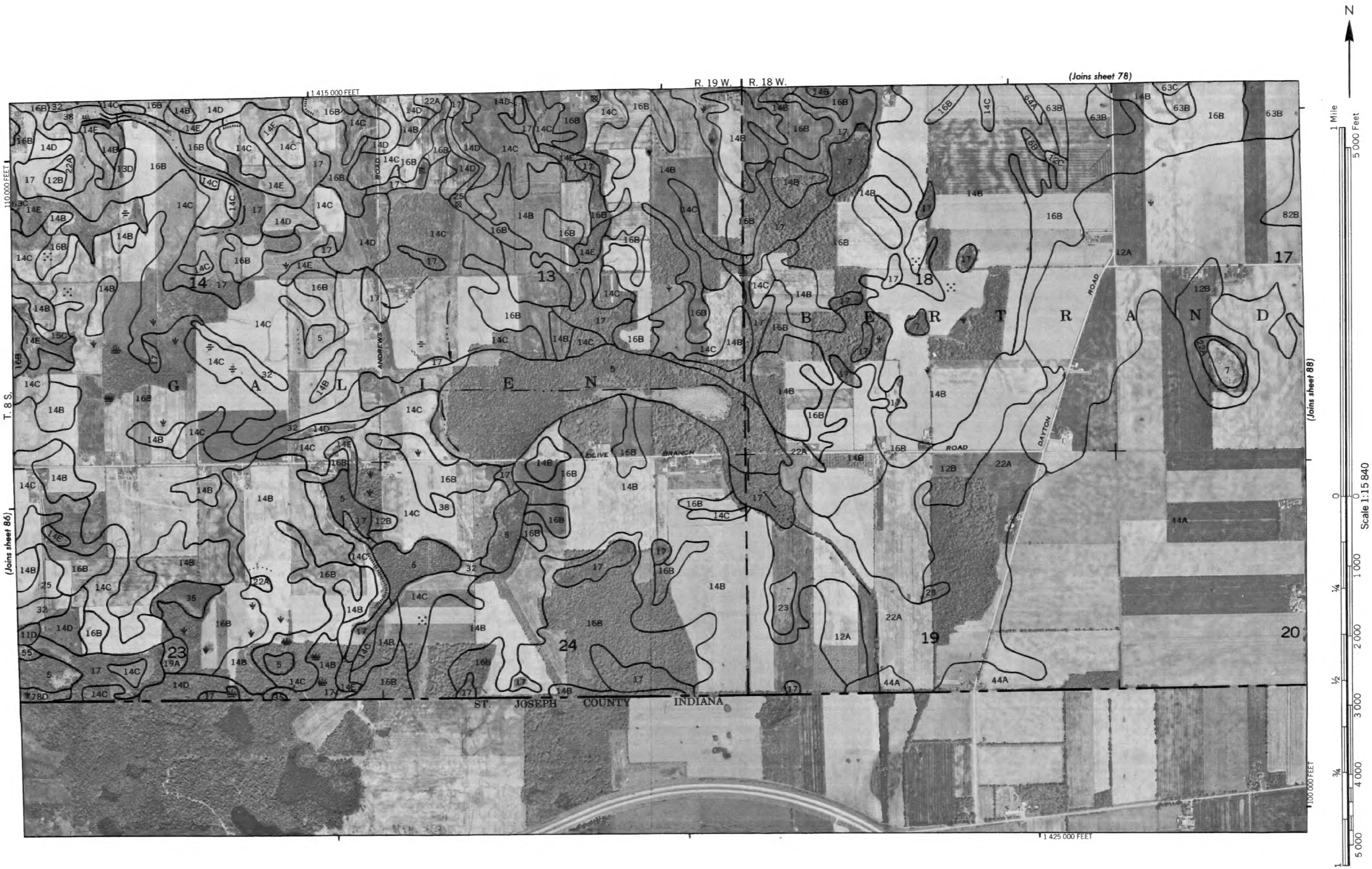

BERRIEN COUNTY, MICHIGAN NO. 87

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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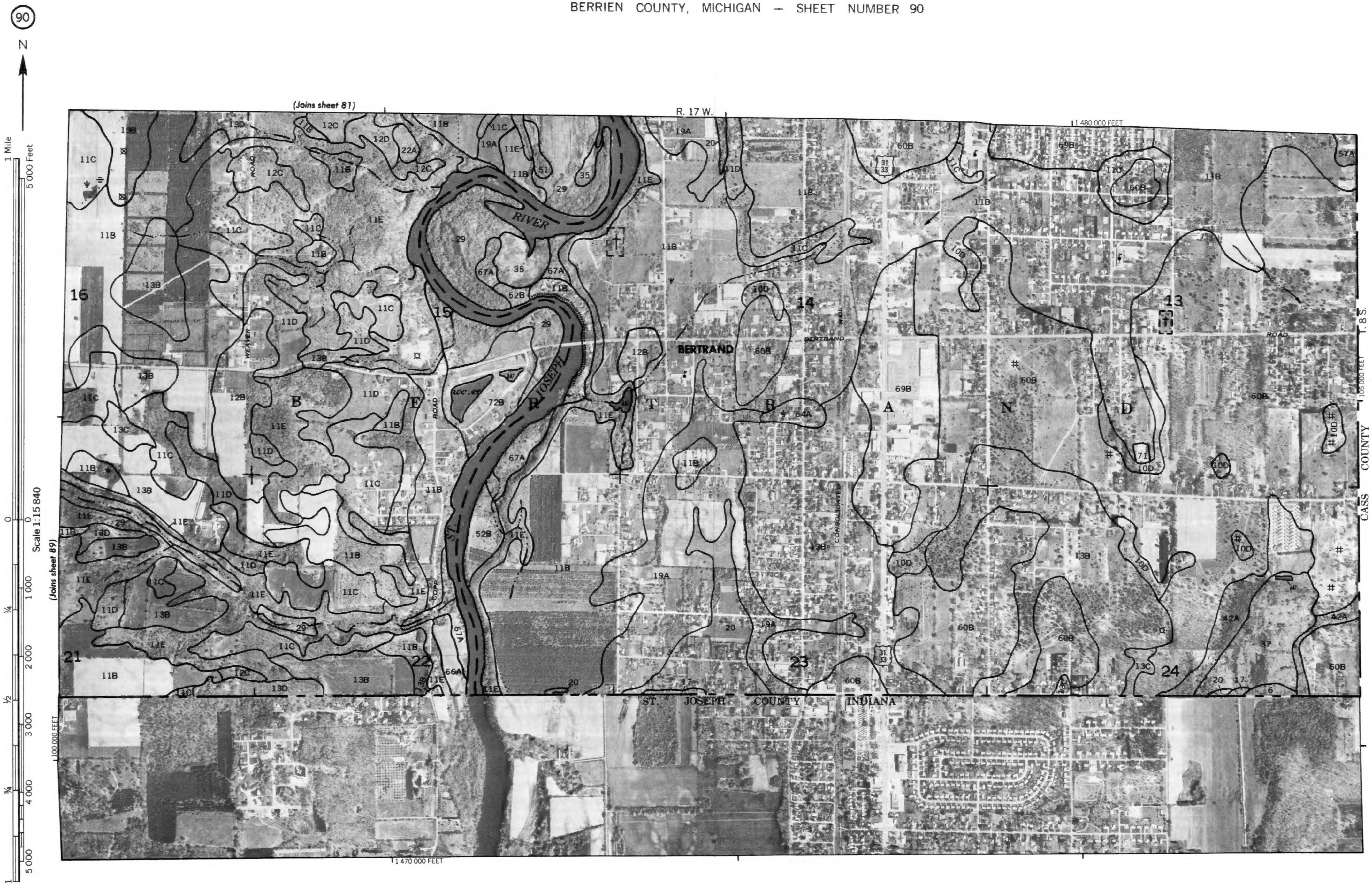
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

BERRIEN COUNTY, MICHIGAN NO. 88

BERRIEN COUNTY, MICHIGAN NO. 89

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.